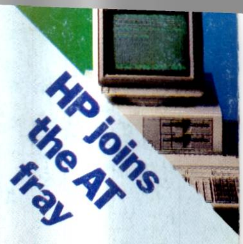

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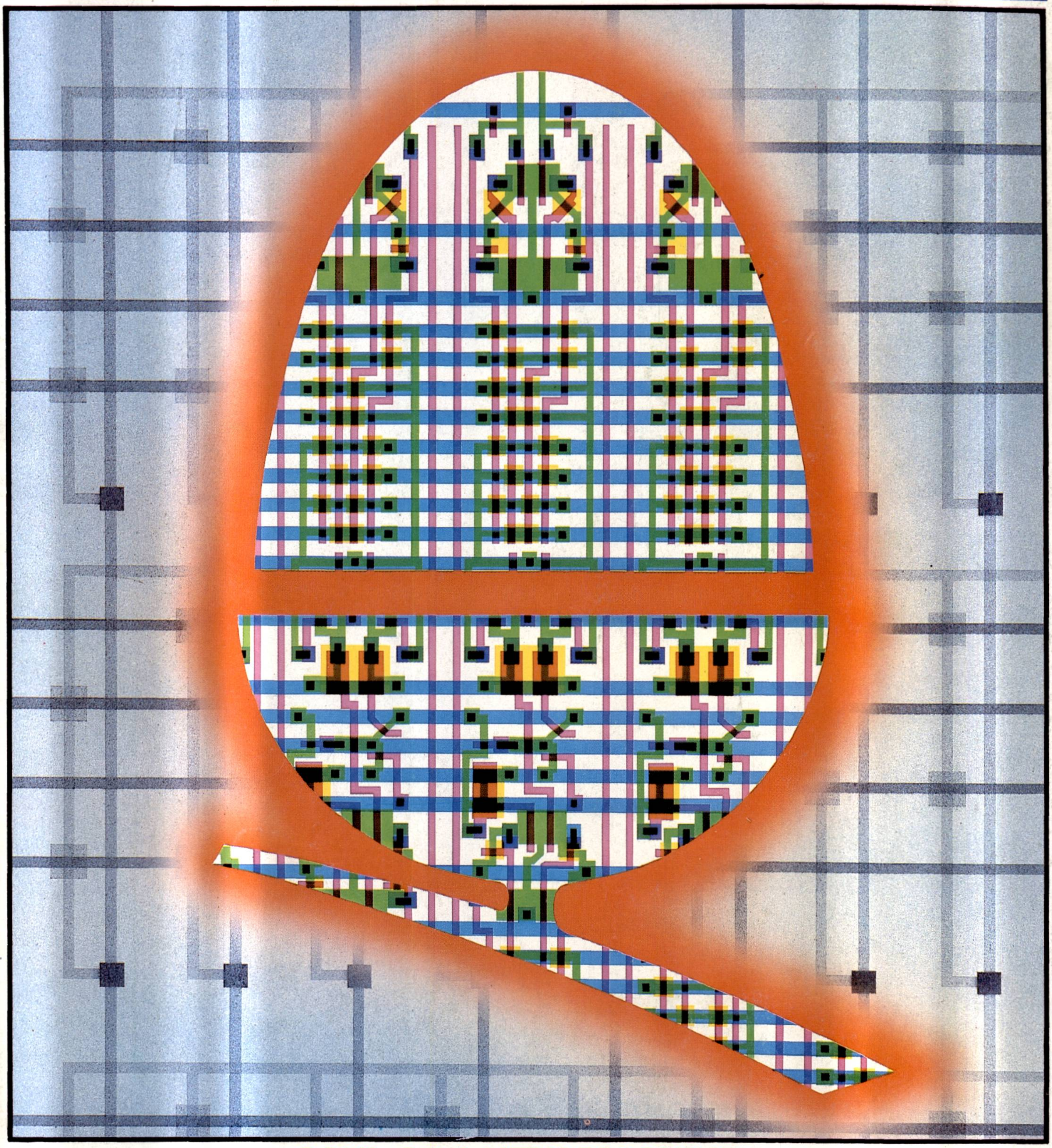

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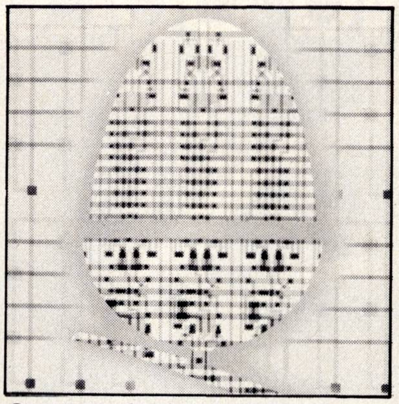

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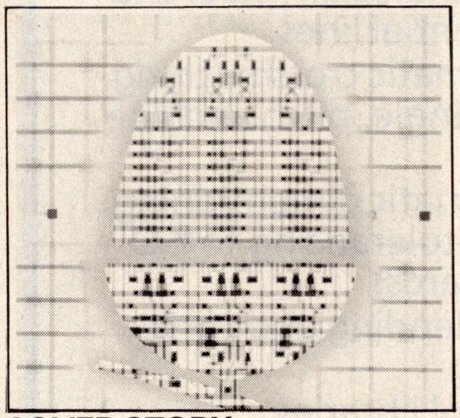

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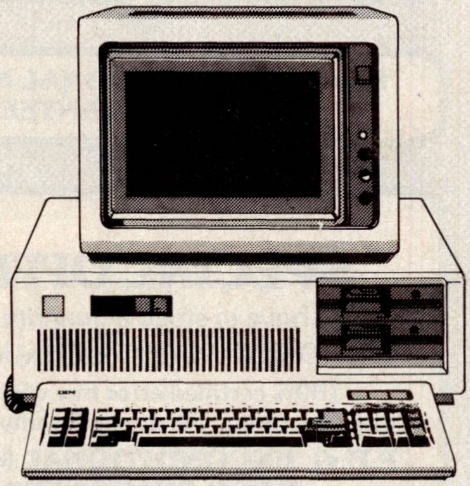

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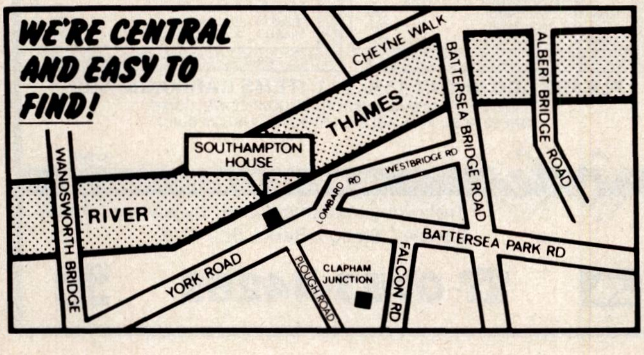

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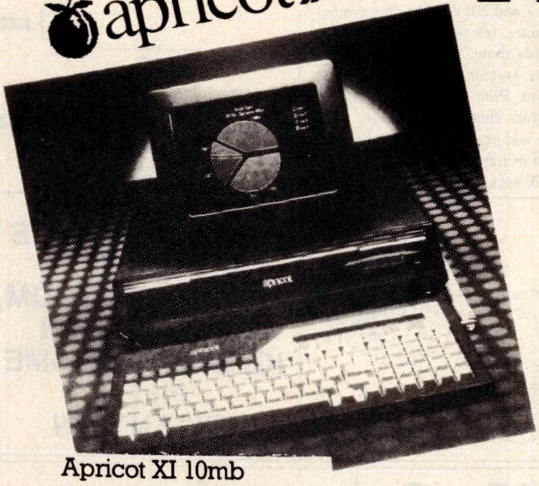

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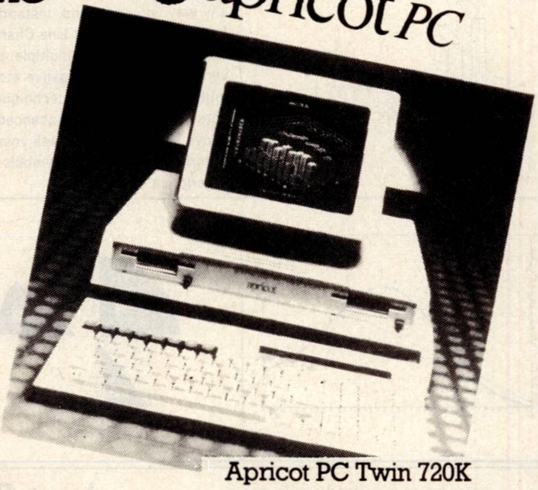

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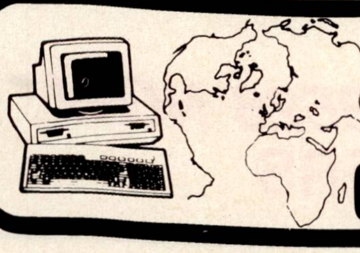

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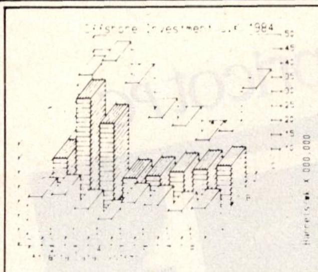

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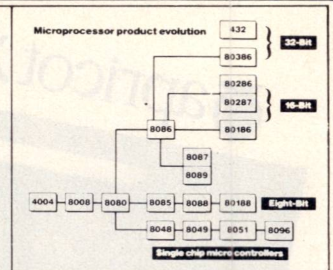

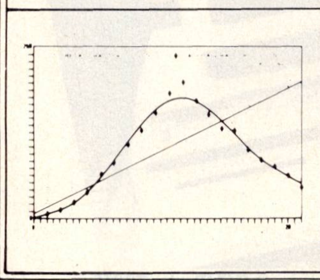

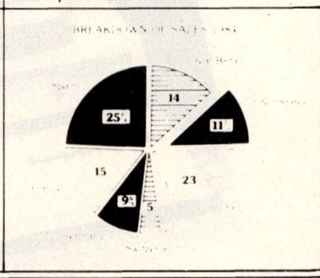

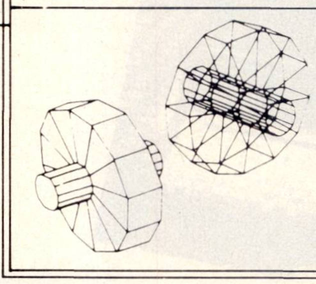

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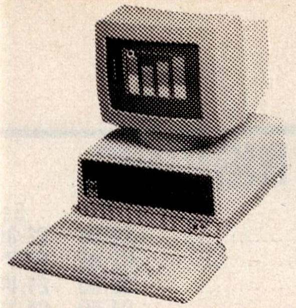

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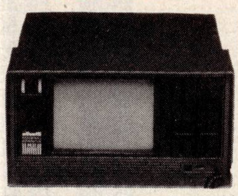

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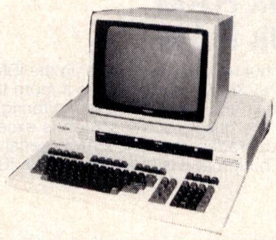

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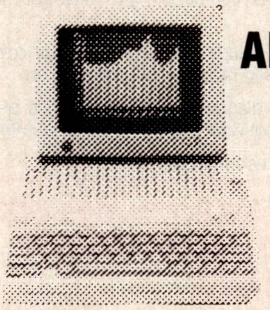

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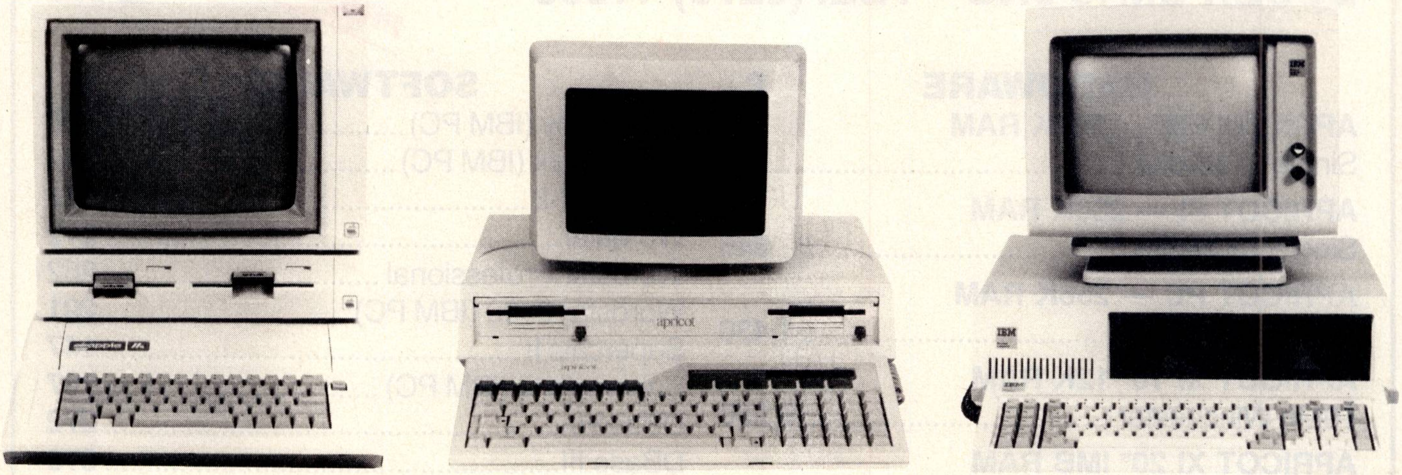

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Apricot xi	10Mb Winchester	8086	5.0MHz	No	Yes	£3485
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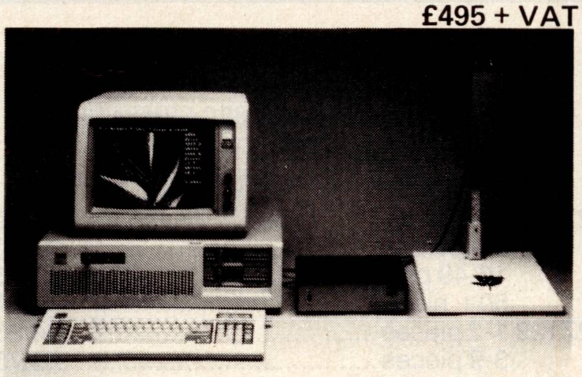

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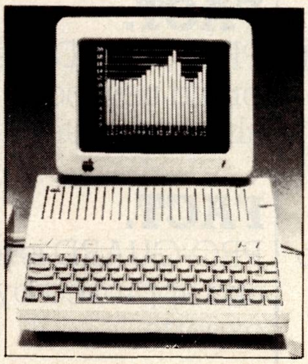

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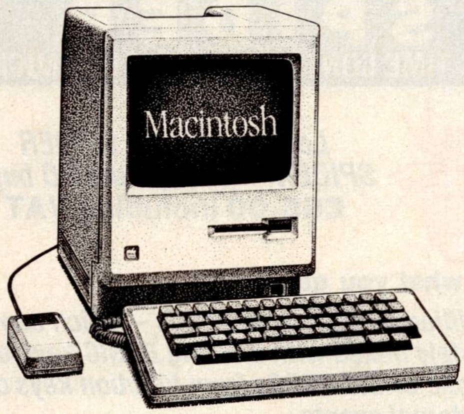

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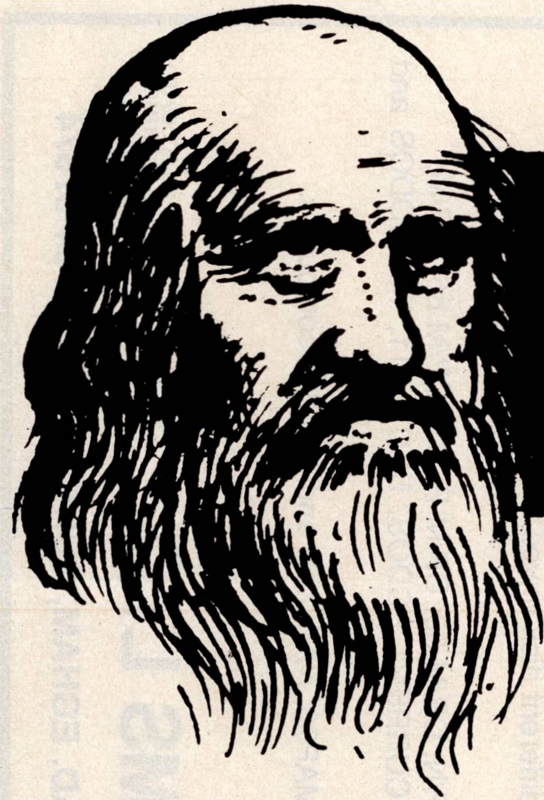

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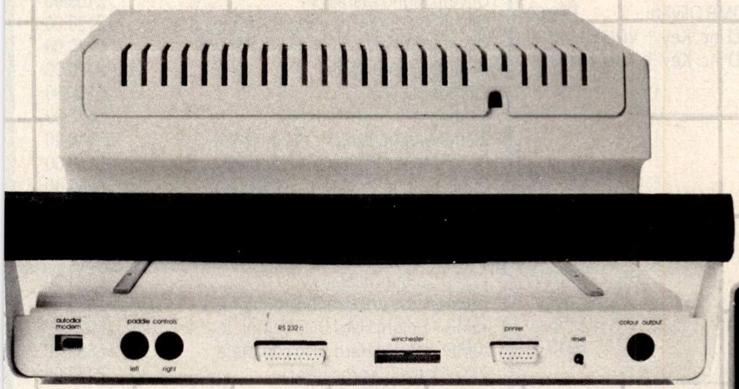

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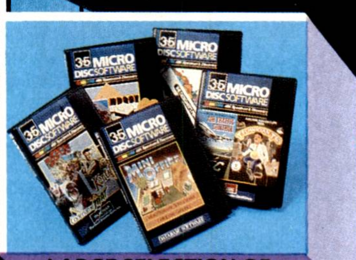

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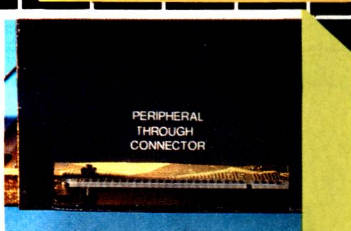

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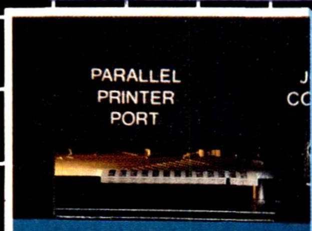

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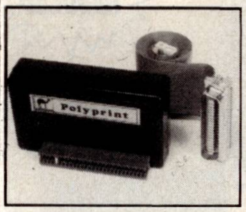

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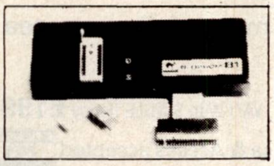
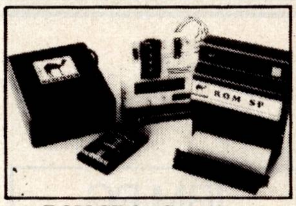


```
STATUS      NO OF SYSTEM —HEX
               EPROM TYPE —27128
          RAM START ADDR —4000
           EPROM ST ADDR — 0000
              JOB LENGTH — 4000
                    TASK — CHECK
-----------------------------------
     WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO
   RAM
Y) BLOW AN EPROM WITH DATA FROM
   RAM
Z) VERIFY THAT EPROM DATA IS THE SAME
   AS IN RAM
Q TO QUIT                 R TO RESTART
— — — — — — — —
      FAST CODES AVAILABLE
  D     H      PQR      WXYZ
```



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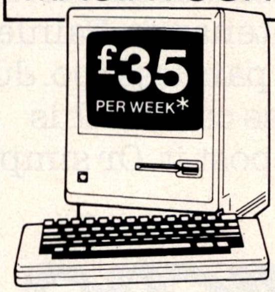

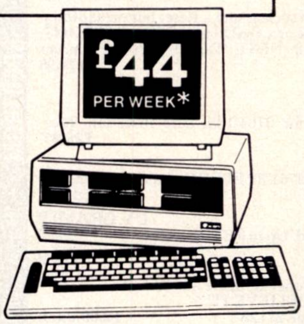

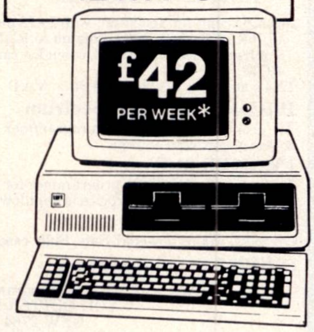

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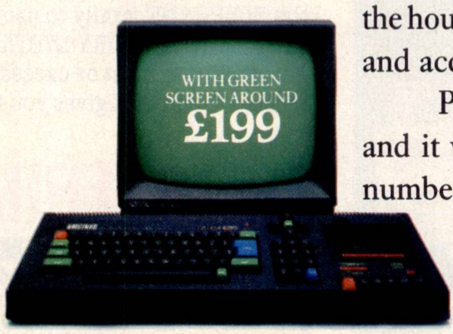

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AS YOU CAN SEE IT ALL COMES DOWN TO THE BOTTOM LINE

Some naive individuals still believe that a higher price automatically guarantees higher performance. These misguided souls are happily shelling out for accounting programs that give them little or no change from £1,000, when Sage Accountant would leave them change from £500. Their mistaken belief is that, at that price, Sage can't possibly be as good.

Actually, Sage isn't that good. It's better. Out of the 19 important functions listed above, Apricot provides a mere 12, while Pegasus does only slightly better with 13. Sage Accountant has got the lot. For roughly half the price.

Whatever your needs, opt for Sage. The most competitively priced accounting package on the market also happens to be the best.

*Comparisons relate to versions for Apricot PC, IBM PC and compatibles. Sage programs are available for a wide range of MS-DOS.

Sage Accountant is just one member of the Sage family of compatible and upgradeable accounting programs. Choose the one to suit your needs from:

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PCW/11/85

More than a w
for less than

Don't look at the price of the Amstrad PCW 8256 or you won't believe what is to follow.

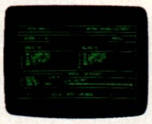
Because the PCW 8256 is a complete wordprocessing system and a complete personal computer at a completely unbelievable price.

It's a powerful wordprocessor.

The PCW 8256 is totally equipped for wordprocessing. It has a high resolution screen with 90 columns and 32 lines of text. That's 40% more usable display area than most PC's.

There's a high speed RAM disc that allows you to store and retrieve information instantaneously, as you're creating a document.

The 82 key keyboard is specifically designed for wordprocessing. Its special function keys allow you to



refer to "pull down" menus as you work, so you don't have to memorise complicated codes. This simply means it's easy to use.

And the PCW 8256 has an integrated printer, with compatible software that gives you a choice of letter quality and high speed drafting capabilities.

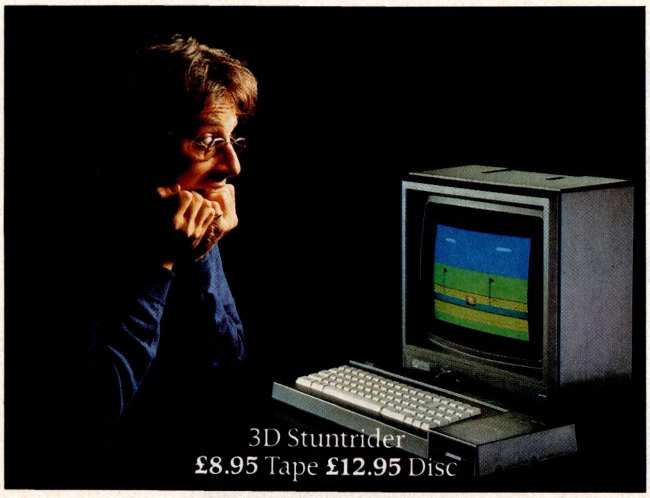
Finally there's an automatic paper load system, as well as tractor feed for continuous stationery. All for the price of an electric typewriter.

It's a powerful computer.

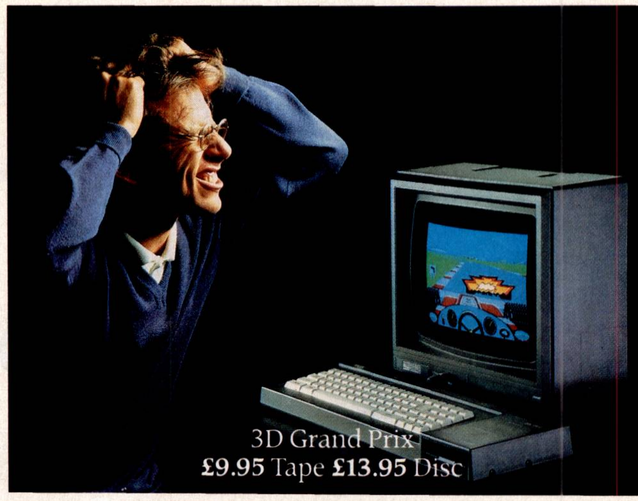
The PCW 8256 is more than a wordprocessor. It's also a purpose built computer with an enormous 256k memory.

By employing the CP/M* Plus computer operating system with 61k TPA, it opens the door to over 8,000 commercial software packages. If that's

FOR A FREE DEMONSTRATION VISIT YOUR LOCAL DIXONS



3D Stuntrider
£8.95 Tape **£12.95** Disc



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When it comes to computer games you can't beat an Amstrad.

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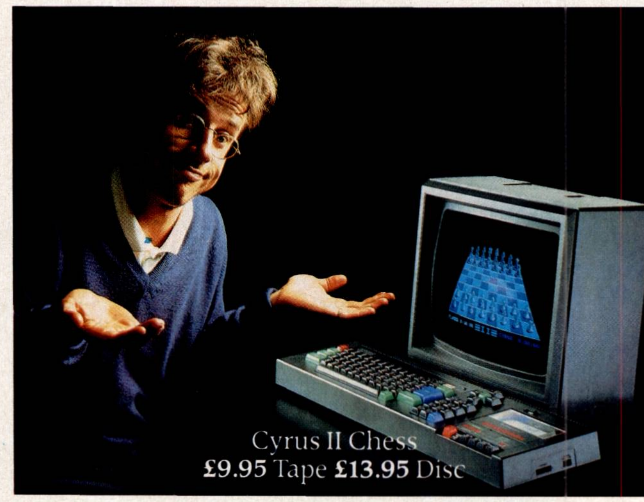

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The 64k CPC 464 computer comes complete with built-in datacorder and a choice of green screen or full colour monitor.

The CPC 6128 is a big memory 128k computer with built-in, fast-loading disc drive and again, it's own colour monitor or green screen.

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PCW/S/1

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TASWORD TWO (Spectrum)

64 characters per line on the screen!

"Without doubt, the best utility I have reviewed for the Spectrum."
HOME COMPUTING WEEKLY APRIL 1984

"If you have been looking for a word processor, then look no further."
CRASH JUNE 1984

The cassette program is supplied with instructions for microdrive conversion.

TASWORD TWO* ZX 48K Spectrum — cassette **£13.90**
microdrive cartridge **£15.40**

TASWORD EINSTEIN

A sixty-four character per line display and the ability to hold over five hundred lines of text at any time are just some of the features of this, the most recent of the Taswords. Full interaction with the disc system — e.g. Tasword detects the presence of added drives and allows their use.

TASWORD EINSTEIN Tatung Einstein — disc **£19·95**

TASWORD MSX

With all the features of the Spectrum Tasword Two including the amazing sixty four character per line display. The Tasword MSX machine code program utilises the 32K of memory not normally available to Basic allowing over five hundred lines of text to be held in memory.

TASWORD MSX* 64K MSX Computers
Fully inclusive mail order price **£13·90**
(cassette includes both disc and tape versions)

TASWORD 464

"There is no better justification for buying a 464 than this program."
POPULAR COMPUTING WEEKLY NOVEMBER 1984

A particularly sophisticated yet easy to use program. Now available on disc. The cassette version is supplied with instructions for transferring to disc.

TASWORD 464* Amstrad CPC 464 & 664 — cassette **£19·95**
disc **£22·95**

TASWORD 464-D

This is the new Tasword especially developed to utilise the capabilities of the CPC 464 and 664 disc drives. A major new feature is a powerful mail merge facility. Tasword 464-D will only run on, and is only supplied on, disc. ▷

TASWORD 464-D Amstrad CPC 464 & 664 — disc **£24·95**

*Available from larger branches of Boots

THE TASPRINT STYLE WRITERS

A must for dot-matrix printer owners! Print your program output and listings in a choice of five impressive print styles. The Tasprints utilise the graphics capabilities of dot matrix printers to form, with a double pass of the printhead, output in a range of five fonts varying from the futuristic Data-Run to the hand writing simulation of Palace Script. A TASPRINT gives your output originality and style! The TASPRINTS drive all Epson compatible eight pin dot-matrix printers, e.g.

	NEC PC-8023B-N	BROTHER HR5
EPSON FX-80	MANNESMANN TALLY MT-80	SHINWA CP-80
EPSON RX-80	STAR DMP 501/515	DATAC PANTHER
EPSON MX-80 TYPE III	COSMOS-80	DATAC PANTHER II

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COMPACTA - bold and heavy, good for emphasis
DATA-RUN - A FUTURISTIC SCRIPT
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MEDIAN - a serious business-like script
PALACE SCRIPT - a distinctive flowing font

Typical Tasprint output. Please note that different makes of printer produce different sized output.

TASPRINT (Spectrum)

Drives all the printer interfaces compatible with TASWORD TWO and can be used to print TASWORD TWO text files as well as output from your own Basic programs.

TASPRINT 48K Spectrum — cassette **£9·90**
microdrive cartridge **£11·40**

TASPRINT EINSTEIN

Print TASWORD EINSTEIN text files in one or more of the TASPRINT fonts.

TASPRINT EINSTEIN — disc **£14·95**

TASPRINT QL

TASPRINT QL includes a screen editor used to modify files created by other commercial software, such as QUILL, or by the user from BASIC. These modified files include TASPRINT control characters and may be printed, using TASPRINT, in one or more of the unique TASPRINT fonts.

TASPRINT QL Sinclair QL — microdrive cartridge **£19·95**

TASPRINT 464

Can be used to print AMSWORD/TASWORD 464 text files in addition to output from your own Basic programs. Drives the **Amstrad DMP-1** in addition to the printers listed above.

TASPRINT 464 Amstrad CPC 464 & 664 — cassette **£9·90**
disc **£12·90**

TASWORD UPGRADES

Tasword 464 and Amsword owners: send your original cassette or disc (not the packaging) as proof of purchase. Your original will be returned together with Tasword 464-D on disc. **£13·90**

QL is a trademark of Sinclair Research Limited

. . . think Tasman

THE TASCOPY SCREEN COPIERS

The TASCOPY screen copiers print high resolution screen copies with different dot densities and patterns for the various screen colours. This gives the screen copies a shaded effect which presents on a monochrome scale the colours on the screen. With TASCOPY you can keep a permanent and impressive record of your screen pictures and diagrams. TASCOPY supports all the printers mentioned under TASPRINT.

TASCOPY (Spectrum & Interface 1)

The Spectrum TASCOPY is for use with the RS232 output on ZX Interface 1. It produces monochrome copies (in a choice of two sizes) as well as copies with the shaded "grey scale" effect described above.

TASCOPY ZX Spectrum	cassette	**£9·90**
	microdrive cartridge	**£11·40**

TASCOPY QL

TASCOPY QL adds new commands to the QL Superbasic. Execute these commands to print a shaded copy of the screen contents. Print the entire screen or just a specified window. TASCOPY QL also produces large "poster size" screen copies on more than one sheet of paper which can then be cut and joined to make the poster, and high speed small copies.

TASCOPY QL Sinclair QL	microdrive cartridge	**£12·90**

TASCOPY 464

Adds two new commands to the 464 Basic to give both a standard shaded screen copy as well as a "poster size" copy which is printed onto two or four sheets which can be cut and joined to make the poster.

TASCOPY 464 Amstrad CPC 464 & 664	cassette	**£9·90**
	disc	**£12·90**

Available from good software stockists and direct from:

TASMAN SOFTWARE

Springfield House, Hyde Terrace, Leeds LS2 9LN · tel (0532) 438301

Telephone Access/Visa orders: Leeds (0532) 438301

PLUS . . .

TASWIDE The Screen Stretcher

With this machine code utility you can write your own Basic programs that will, with normal PRINT statements, print onto the screen in the compact lettering used by TASWORD TWO. With TASWIDE you can double the information shown on the screen!

TASWIDE ZX 16K + 48K Spectrum	**£5·50**

TASMERGE The Mail Merger

Transfer data from MASTERFILE to TASWORD TWO! Letters and forms typed on TASWORD TWO can be printed with addresses and data taken from MASTERFILE. The mail merge facility allows, for example, multiple copies of a letter to be printed, each containing a different name and address taken from your MASTERFILE data. To use TASMERGE you must have one or more microdrives as well as TASWORD TWO and MASTERFILE by Campbell Systems (version 9 or later).

TASMERGE ZX 48K Spectrum	**£10·90**

TASMAN PRINTER INTERFACE

Plug into your Spectrum and drive any printer fitted with the Centronics standard parallel interface. Supplied complete with ribbon cable and driving software. The user changeable interface software makes it easy to send control codes to your printer using the method so successfully pioneered with TASWORD TWO. The cassette contains fast machine code high resolution full width SCREEN COPY SOFTWARE for Epson, Mannesmann Tally, Shinwa, Star, and Tandy Colour Graphic (in colour!) printers. TASCOPY, shaded screen copy software for this interface (value £9·90 — see description on left) is included in this package.

CENTRONICS INTERFACE ZX Spectrum	**£39·90**

COMPUTER PRINTER CABLES

RS232 for ZX INTERFACE 1	**£14·50**
MSX CENTRONICS	**£8·00**
AMSTRAD CPC 464 CENTRONICS	**£9·90**

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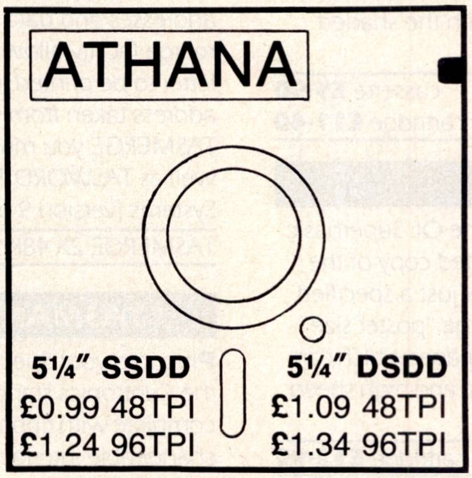

THESE DISKETTES ARE SOLD IN MULTIPLES OF 25 ONLY. DISKETTES ARE SHIPPED WITH TYVEK SLEEVE, REINFORCED HUBS, USER ID LABELS AND WRITE PROTECT TABS.

WHO IS ATHANA?

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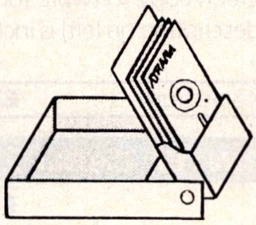
DISKETTE STORAGE CASES



OUR PURCHASING DEPT. MADE A MISTAKE AND PURCHASED THESE STORAGE CASES. WE DON'T WANT 'EM SO OUT THEY GO AT .87P + VAT OR BUY 50 DISKETTES AND PAY ONLY £3.42 + VAT FOR 5. THEY ARE RED AND EACH ONE STORES 10 DISKETTES. OFFER GOOD WHILE THEY LAST.

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HOW TO ORDER
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FOR FAST SERVICE CALL THE ABOVE NUMBER. USE YOUR ACCESS/VISA CARD. COD IS OK TOO! SHIPMENT IS WITHIN 48 HOURS AND WE OFFER A MONEY BACK GUARANTEE. ADD £2.00 FOR POSTAGE & PACKING. PLUS VAT. Minimum order £15

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Athana International Ltd.

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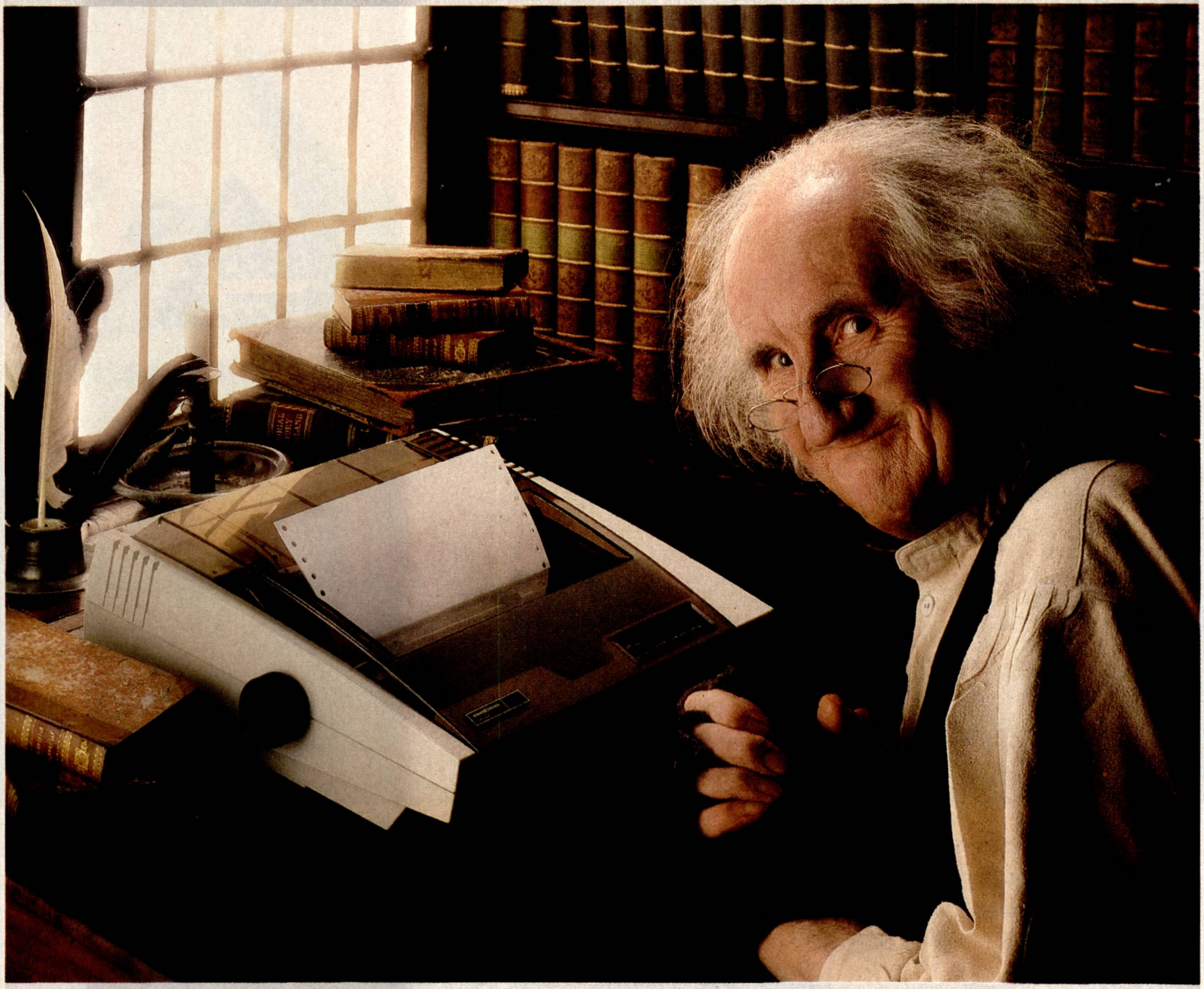
Thrifty micro owners choose the new MT80+



Keen on saving money? But not prepared to sacrifice quality and performance? Then the new MT80+ serial matrix printer has plenty to offer at a price that will have you rubbing your hands with glee.

The MT80+ prints at 100 cps and is compatible with just about any popular office or home micro. For true print flexibility, there's compressed and expanded print, subscripts and superscripts, bold print, italics and, of course, graphics.

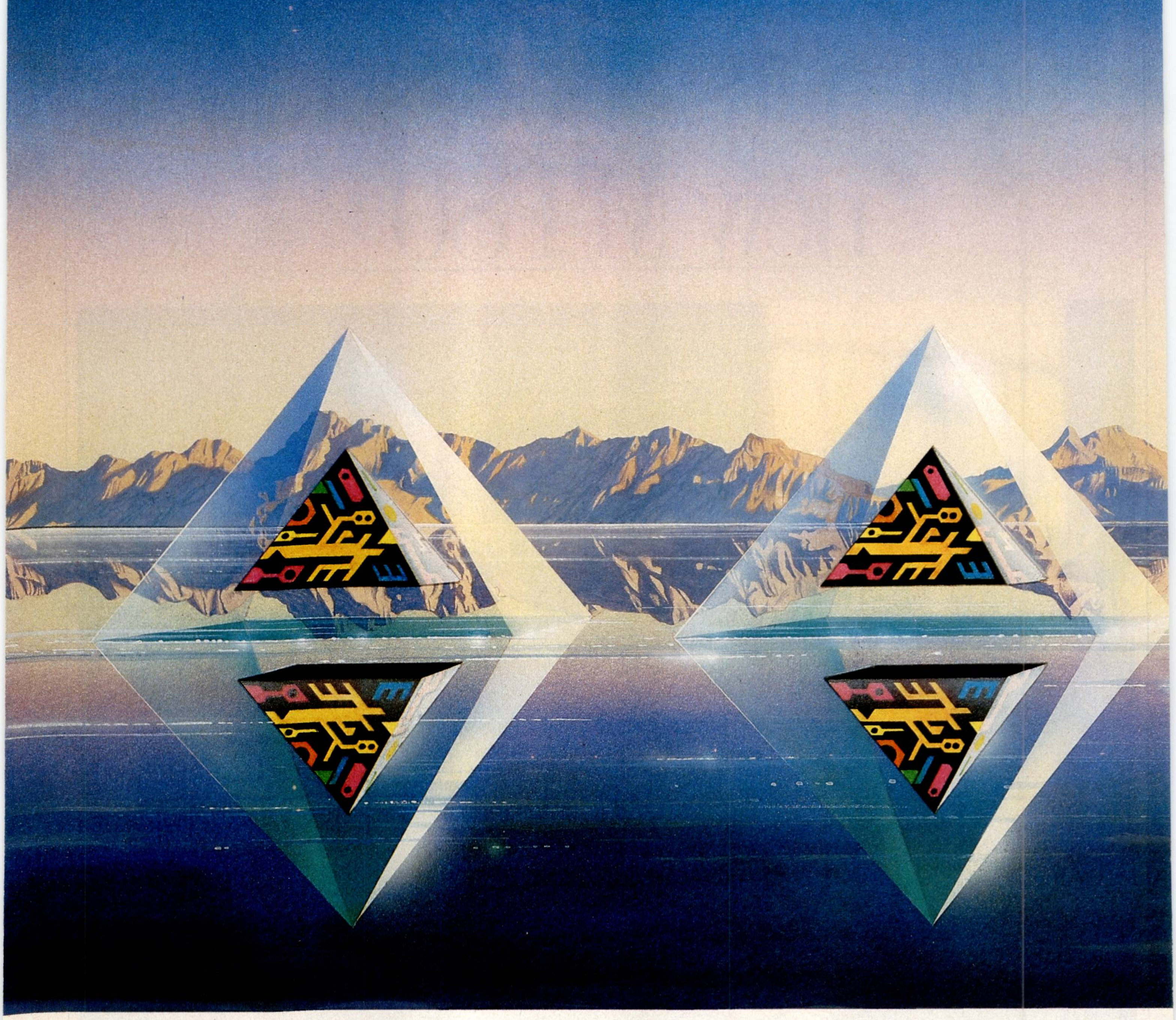
You'll have to see the print quality to believe it, thanks to the outstanding film ribbon cassette. Continuous fanfold stationery or friction fed single sheets pose no problem. And if you're in a hurry the quick tear facility is a real bonus.

The new MT80+ from Mannesmann Tally. Europe's leading matrix printer manufacturer. You'll be laughing all the way to the bank. Contact us now for our literature pack.

MANNESMANN TALLY

MANNESMANN TALLY LIMITED, MOLLY MILLARS LANE, WOKINGHAM, BERKSHIRE, RG11 2QT. TELEPHONE (0734) 788711

HIGH FOCUS - THE NEW



When Europe's largest computer media specialist gets excited about a new generation of floppy disks, it has to be something special. Very special in fact.

The new RPS High Focus generation of floppies is just that.

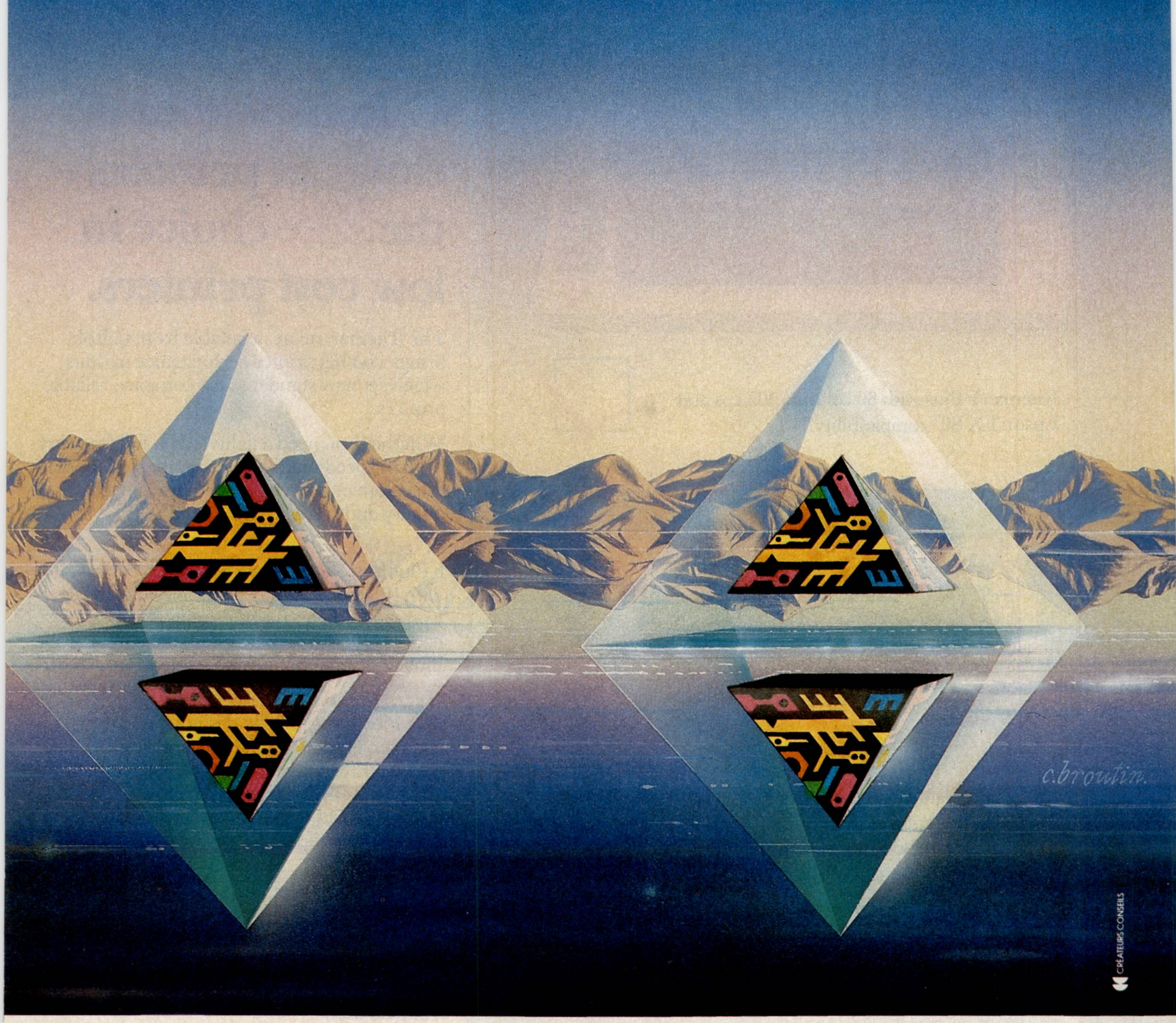
High Focus is the result of the revolutionary coating process developed by Rhône Poulenc for the ultra High Density floppies used by the new generation of micros.

High Focus guarantees the highest and most consistent precision performance - even under adverse operating conditio

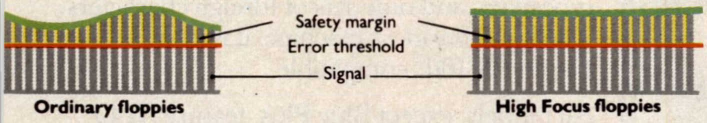
The new RPS High Focus floppies are made using enhanced isotropic coating process. This coating ensur even distribution of oxide particles to provide the highe precision definition ever attained by a floppy disk - Hi Focus laser precision.

With ordinary, non-isotropic coate floppies, the magnetic oxide particl which make up the coating layer te to be oriented in one direction, usua towards the long axis of the tape r from which they were punched.

DISK GENERATION



The result is a cyclical variation in the signal received om the read head - Where the signal is weak, the safety ıargin above the error threshold is at a minimum.



Under adverse conditions, the signal is reduced and can ctually fall below the error threshold, making the disk nreadable. The unique isotropic coating provides RPS ligh Focus floppies with randomly oriented magnetic par-cles so there is no signal variation - guaranteeing constant precise information recording and the safety margin maintained at an optimal level whatever the conditions of use.

RPS High Focus disks take floppies into a new generation - High Focus - guaranteed laser precision.

RPS

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MODEL	SPECIFICATION	PRICE
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KAGA KP910 OR CANON PW1156		£330
PLOTMATE FLATBED PLOTTER FOR BBC	A DRAWING COMPANION FOR YOUR BBC MICRO. PAPER OR OVERHEAD FILM. RANGE 198×290 UP TO B4 SIZE. FAST, ACCURATE, EASY TO USE.	SPECIAL £285 OFFER
SEIKOSHA SP1000	100CPS DRAFT, 25CPS NLQ, F/T GREAT VALUE	SPECIAL £199 OFFER

MODEL	SPECIFICATION	PRICE
JUKI 6100	20 CPS, PARALLEL I/F, OPTIONAL TRACTOR/SHEET FEEDER	£294
QUENDATA 1120 ORUCHIDA	20 CPS, PARALLEL, INTERFACE, OPTIONAL TRACTOR/FEEDER	£195
STAR SG10 NEW	120CPS, 45CPS NLQ, F/T, IBM COMPATIBLE, SUPERB RANGE OF PRINTERS	£205
STAR SG15 132 COL		£299
EPSOM LX80 NEW	100CPS, 22CPS NLQ, F/T SUPER PRINTER	£197

MONITORS

MICROVITEC 1431	452 × 585 PIXEL RESOLUTION RGB INPUT STD RES	£186
MICROVITEC 1451 (MED RES)	653 × 585 RES RGB INPUT MED RES	£240
MICROVITEC 1451 DQ3 FOR QL	653 × 585 PIXELS, 85 COL DISPLAY FOR QL, RGB I/P	£229
SINCLAIR VISION QL	AS ABOVE 85 COL, 12″ COLOUR DISPLAY	£229
PHILIPS 7502 GREEN	2000 CHARACTER DISPLAY BANDWIDTH > 18MHz, COMP. I/P	£69
PHILIPS 14″ COLOUR TV/MON	14″ COMPUTER MONITOR/TV, SUPERB PICTURE	£199

COMPUTERS AND SOFTWARE

NEW AMSTRAD CPC6128 COL. MON	A GREAT VALUE MICRO WITH LARGE 128K RAM, BUILT IN DISK DRIVE, COLOUR OR GREEN MONITOR, CP/M ETC	£346
CPC6128 + GREEN MON		£259
NEW AMSTRAD 8256	THE COMPLETE SOLUTION TO WORD PROCESSING & SERIOUS COMPUTING NEEDS. 256K, DISK BASED + MONITOR + PRINTER	UNBELIEVABLE PRICE £395
SINCLAIR QL LOW PRICE	128K, PLUS FREE SOFTWARE NOW WITH ADD ONS ETC	£174
APRICOT Fle	SUPER VALUE COMPUTERS FROM ACT. 256K RAM SINGLE 320K OR 740K DRIVE. GREEN OR COLOUR MONITOR AVAILABLE	£569
APRICOT FI		£799
COMMODORE 128 NEW	ADVANCED MICRO, 128K RAM, 80 × 25 LINES, THREE COMPUTERS IN ONE: 64K MODE, 128K MODE AND CP/M MODE. SUPER VALUE	£234
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NEW ATARI 520	68000 PROCESSOR, 512K RAM 700K DRIVE, MOUSE, GEM SOFTWARE AND B/W MONITOR ALL	£639

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ELEPHANT BRAND 5¼″	£17	£22	£28	11×14½″ (2000) £16

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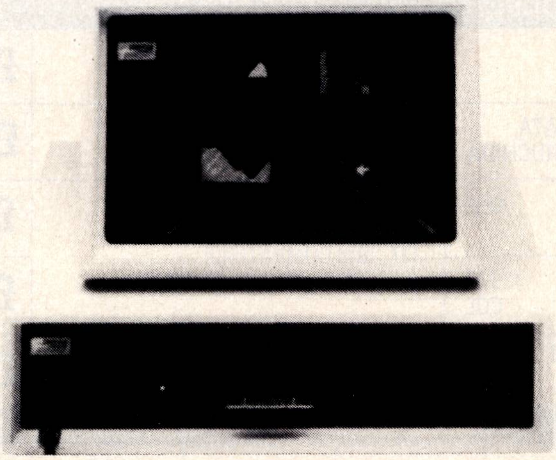

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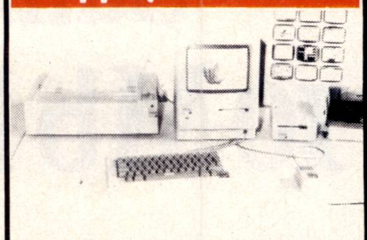

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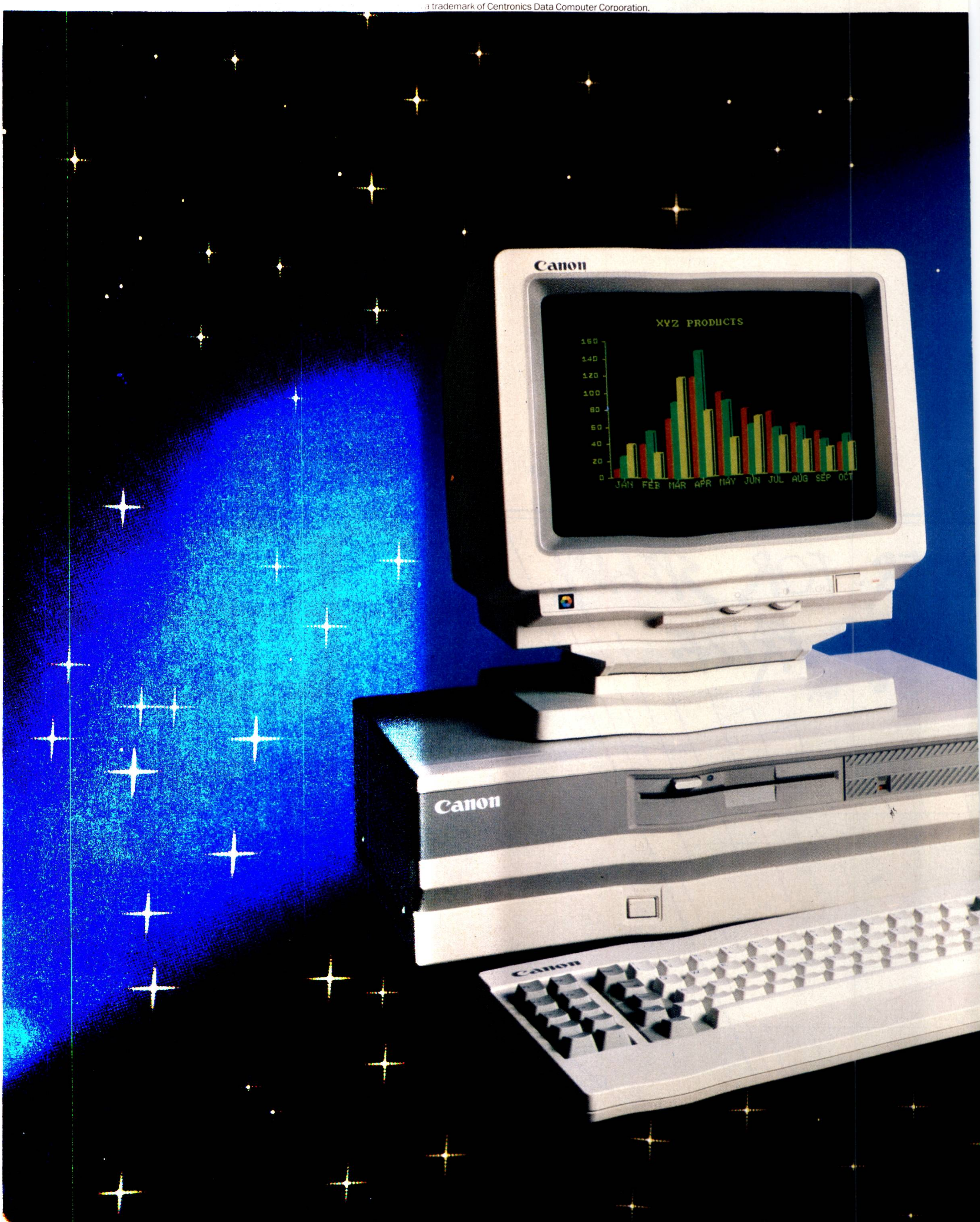

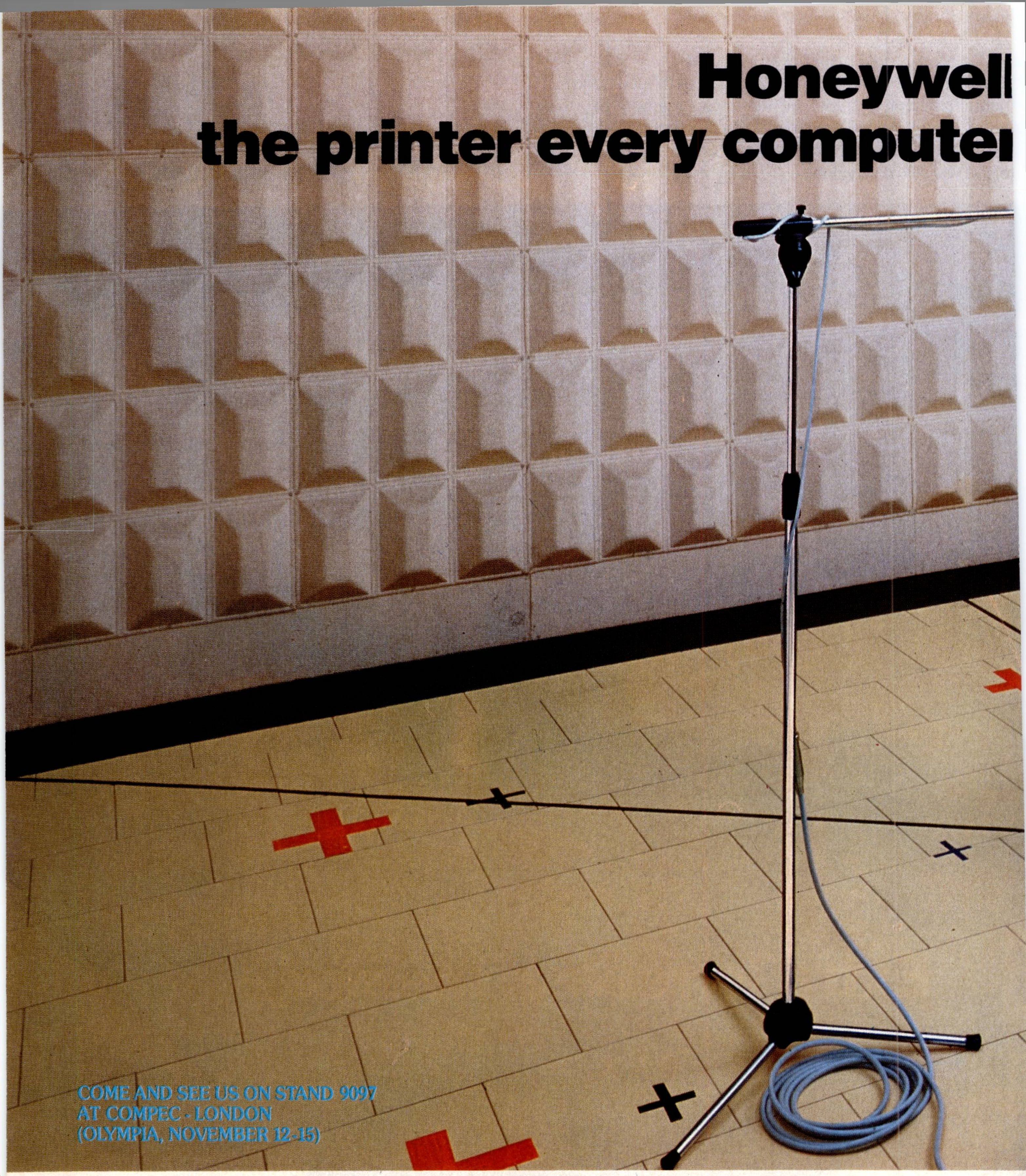

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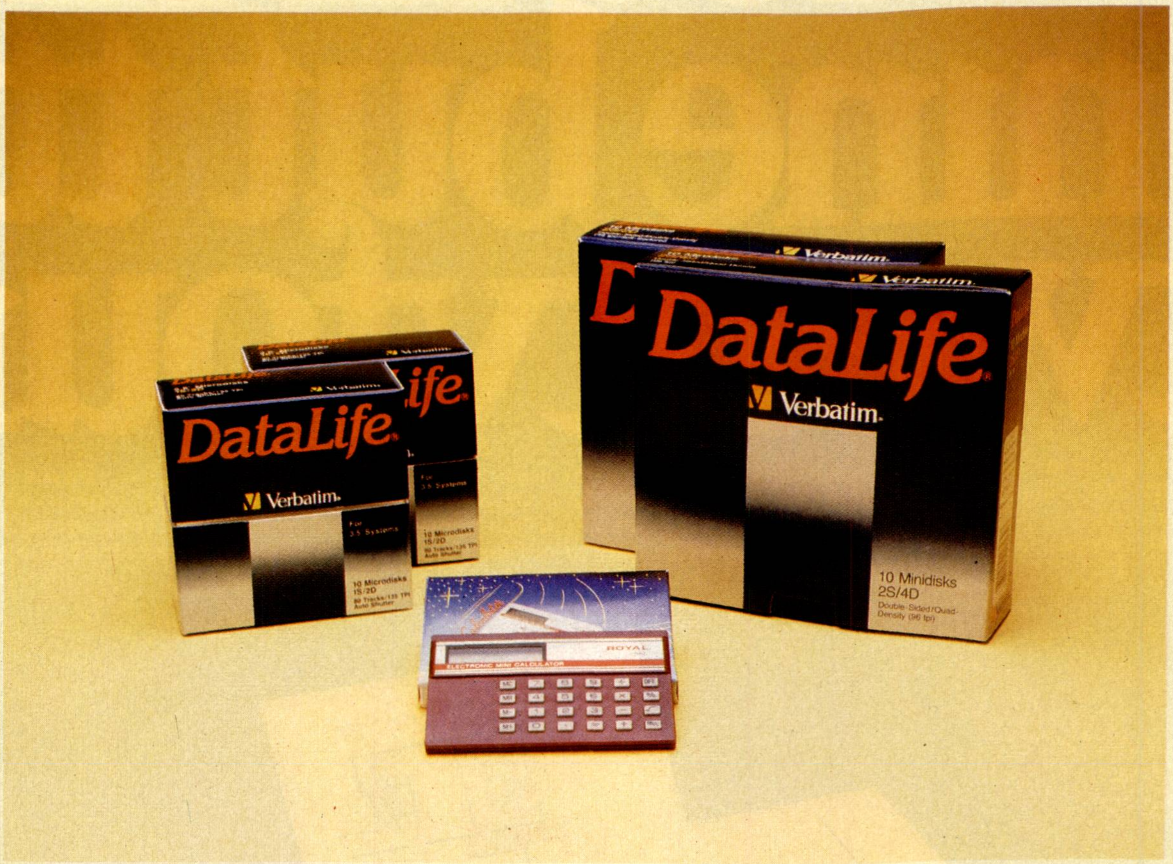

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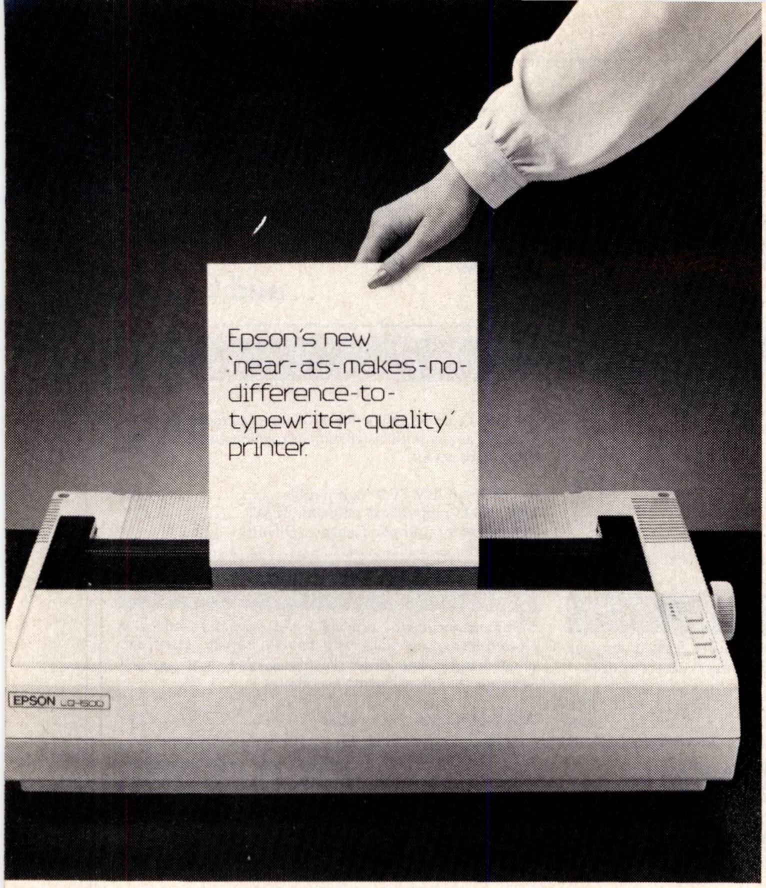

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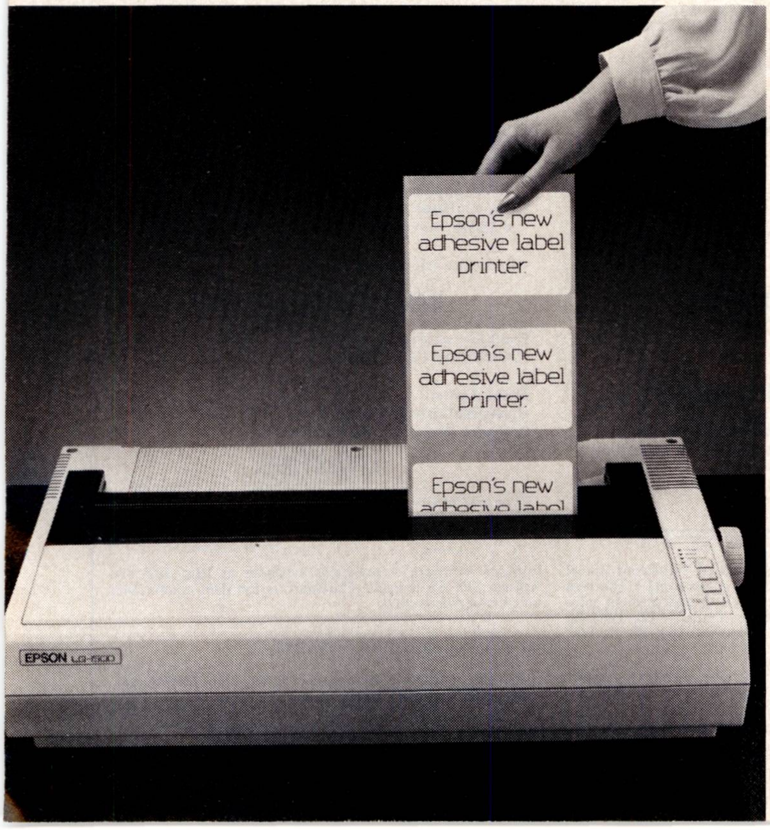

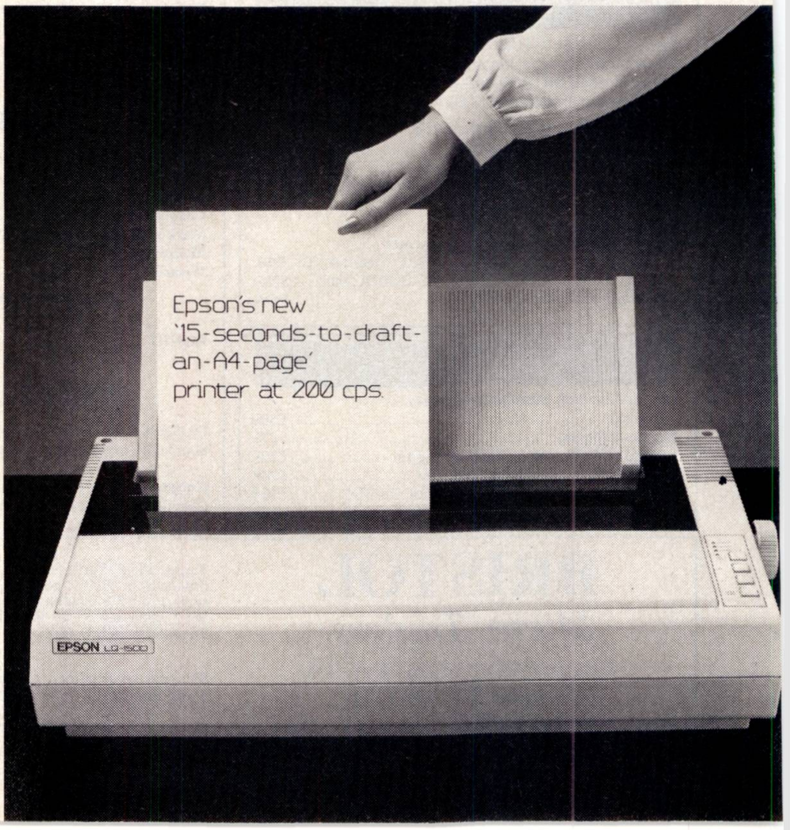

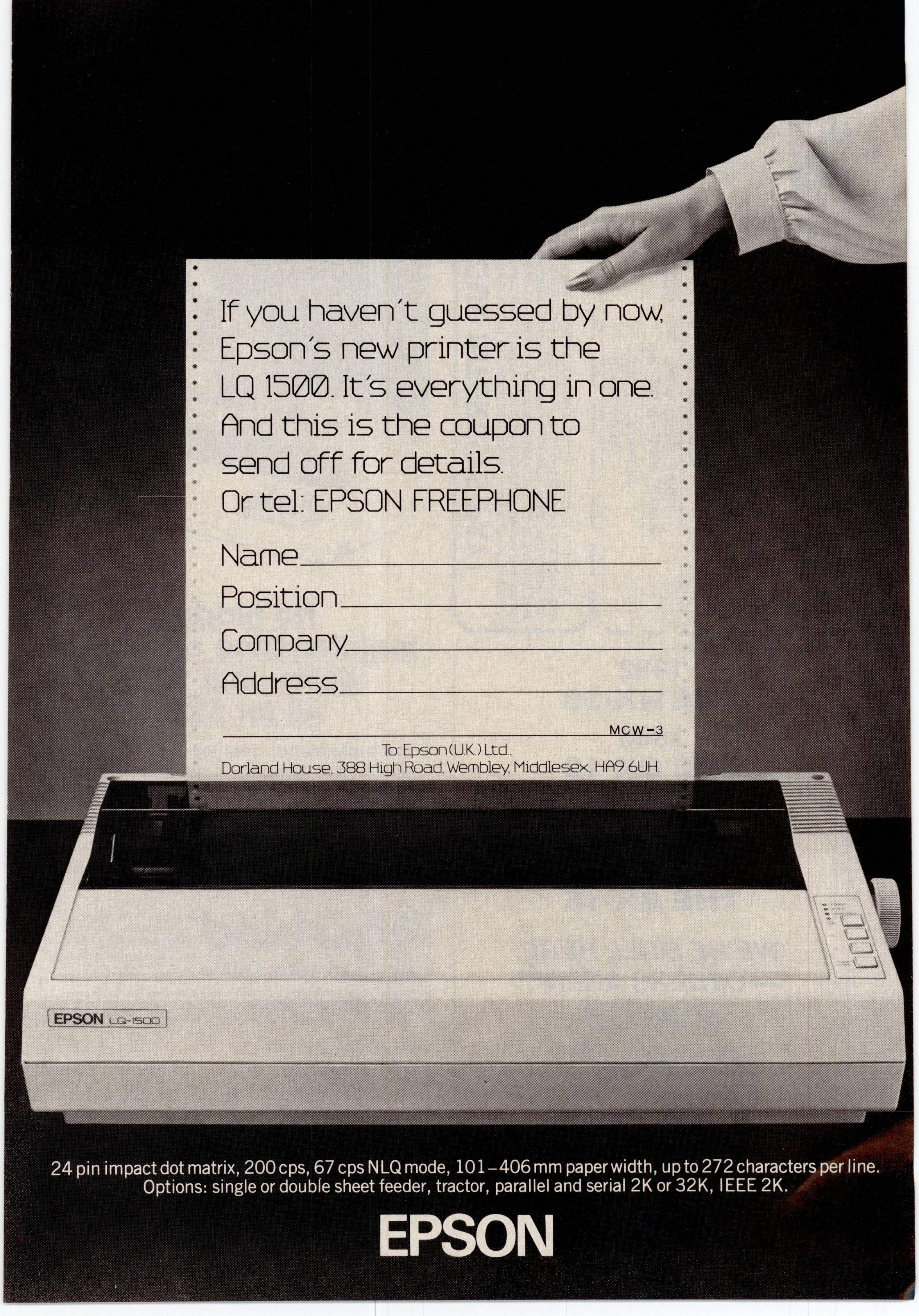

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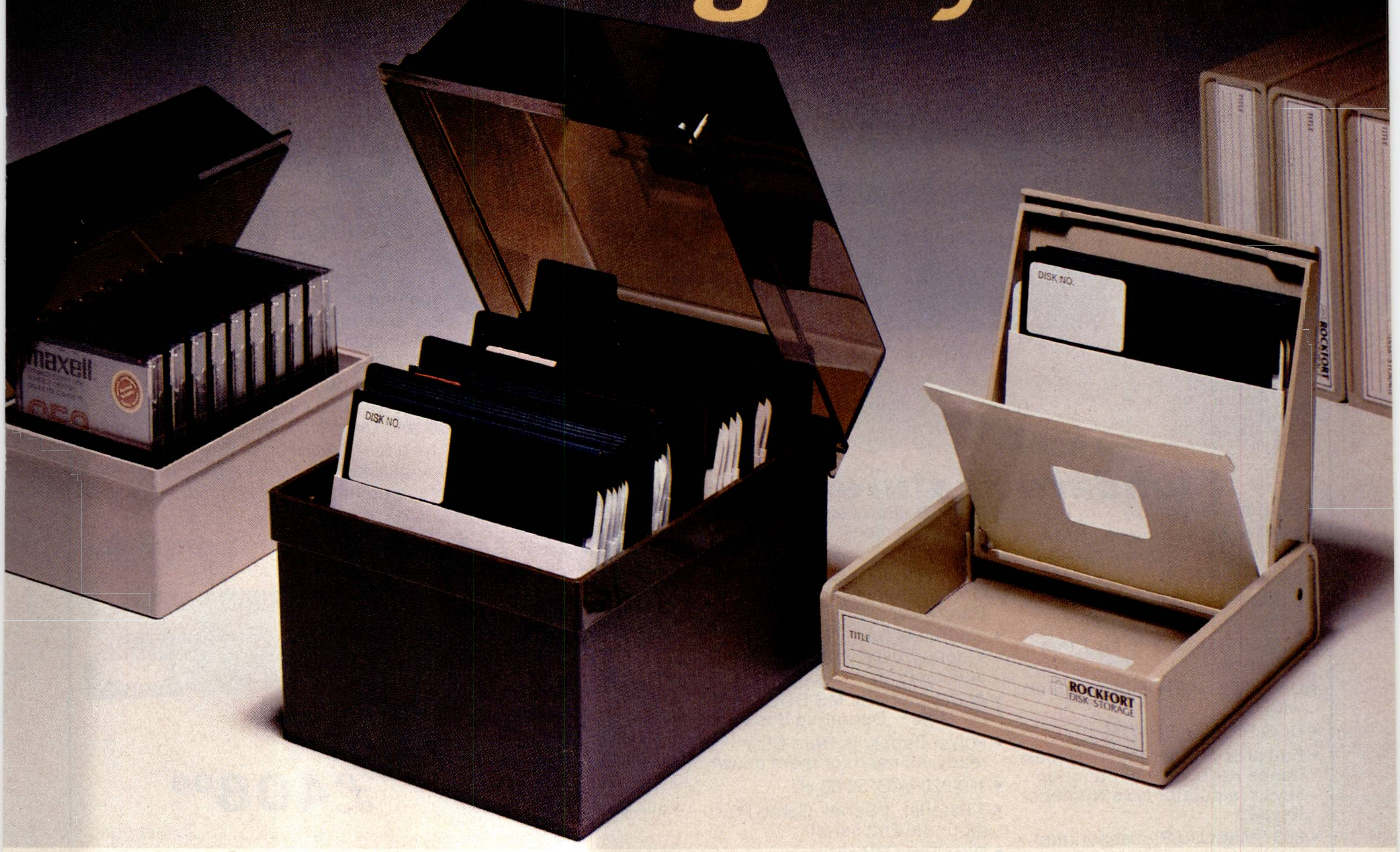

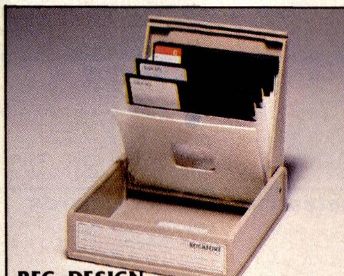

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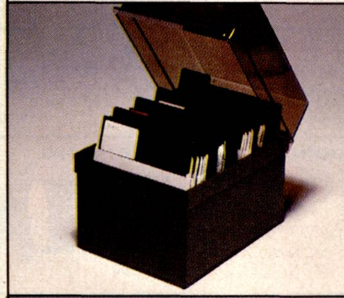

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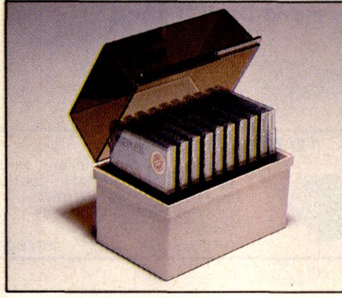

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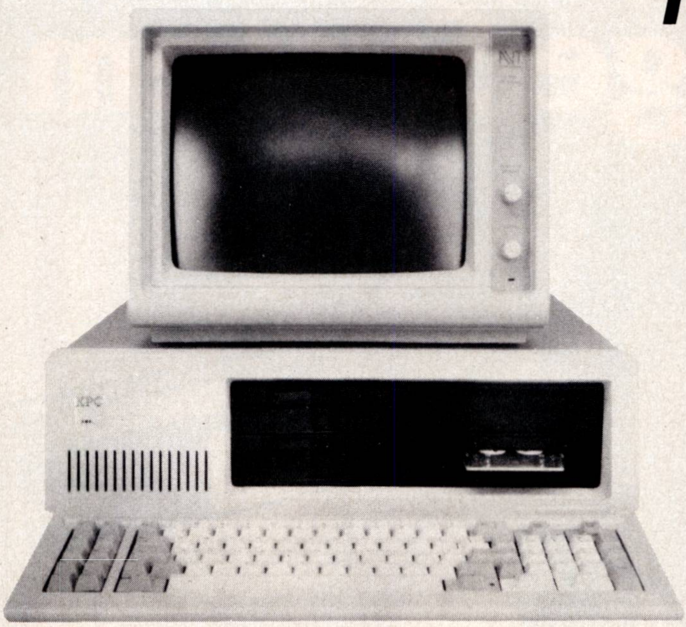

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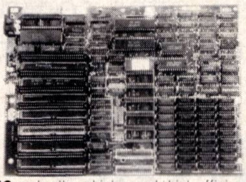

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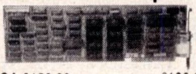

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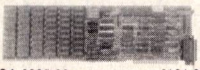
12 PAK Multifunction



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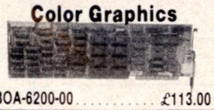

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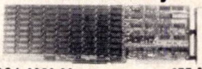

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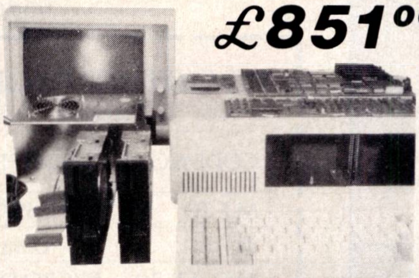

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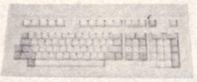

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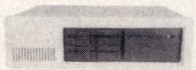

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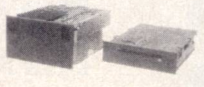

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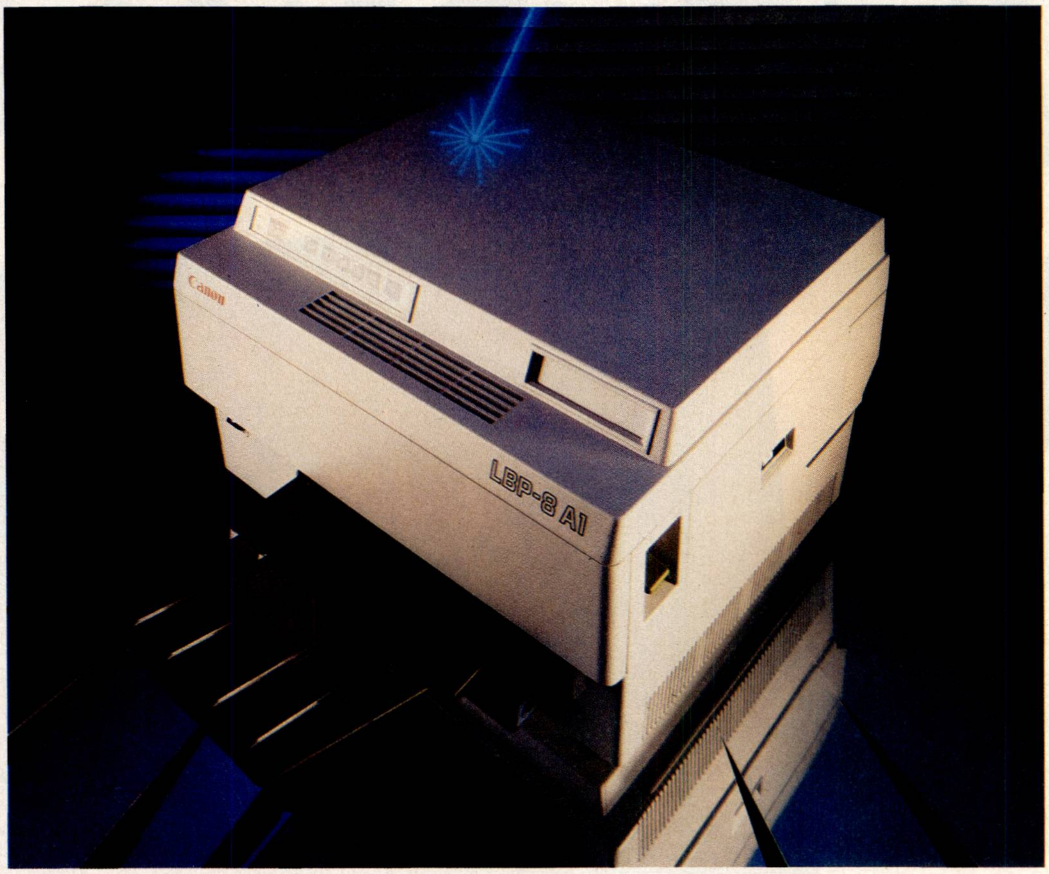

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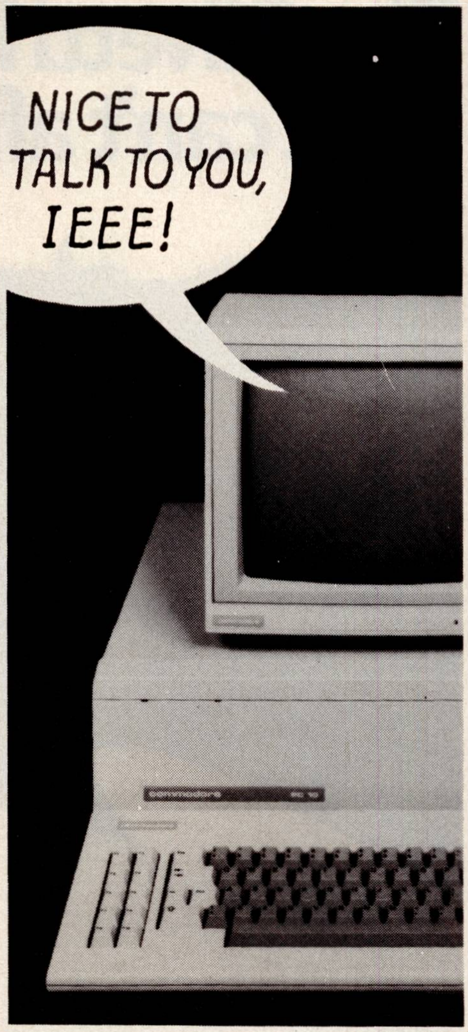

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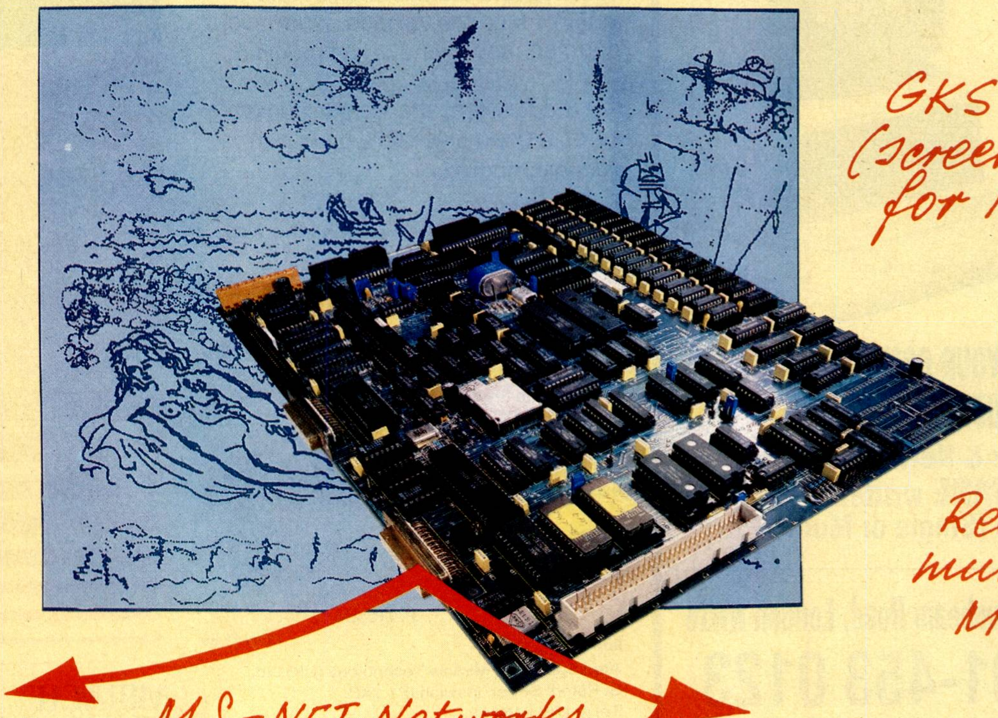

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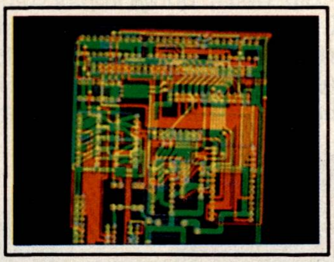

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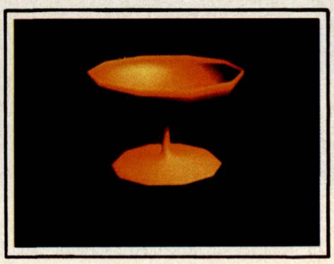

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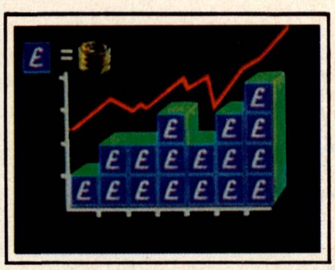

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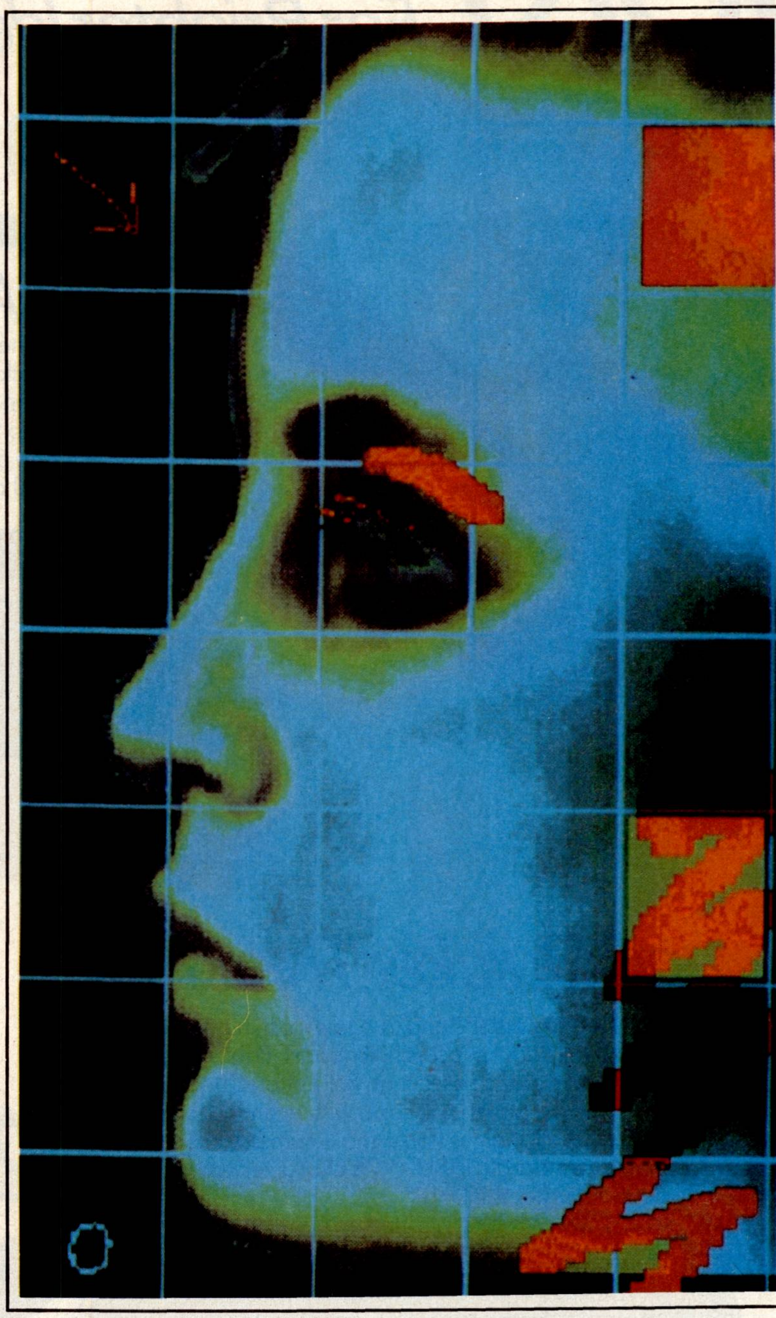

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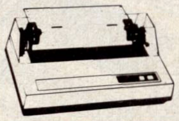

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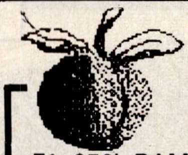

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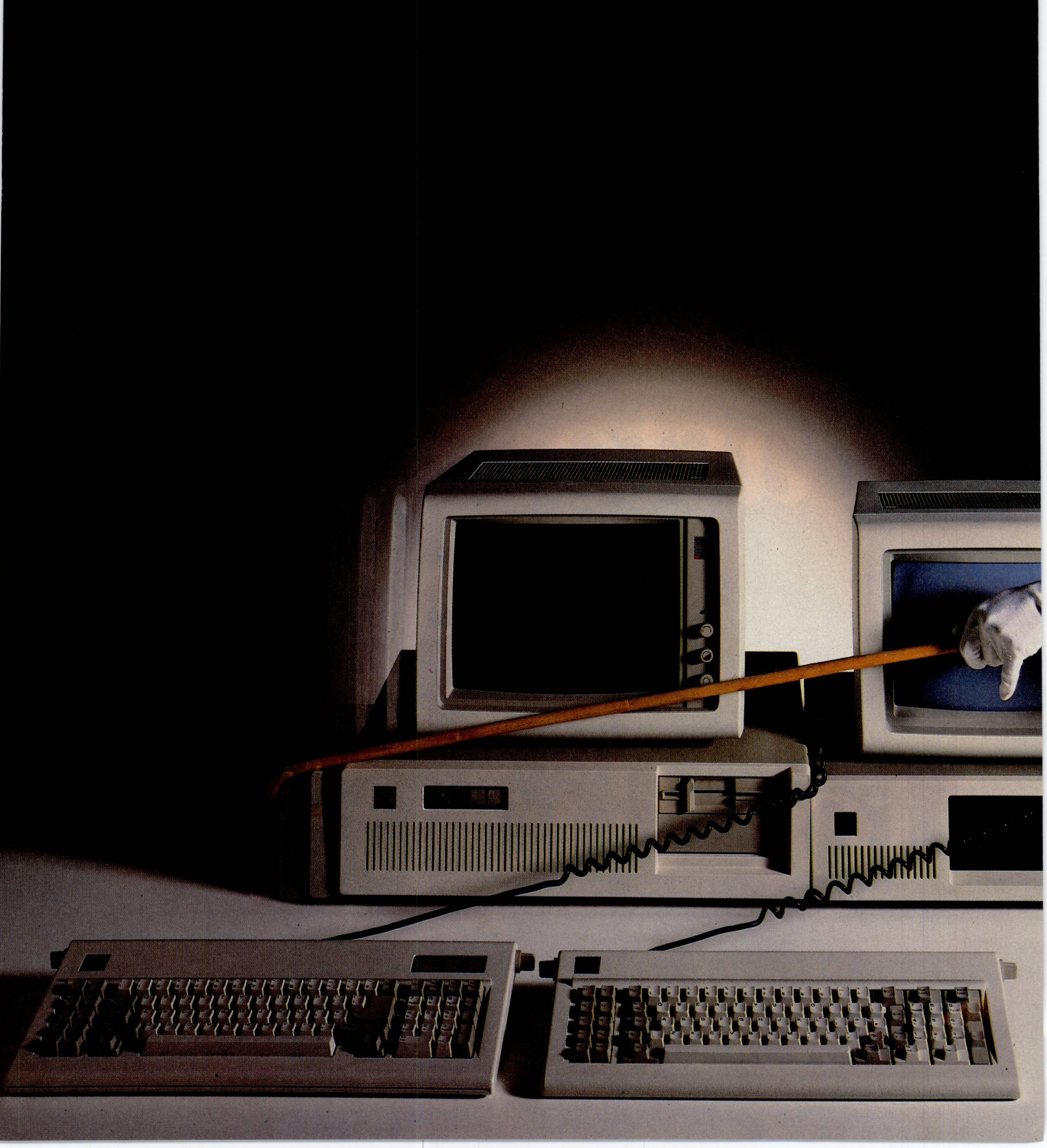


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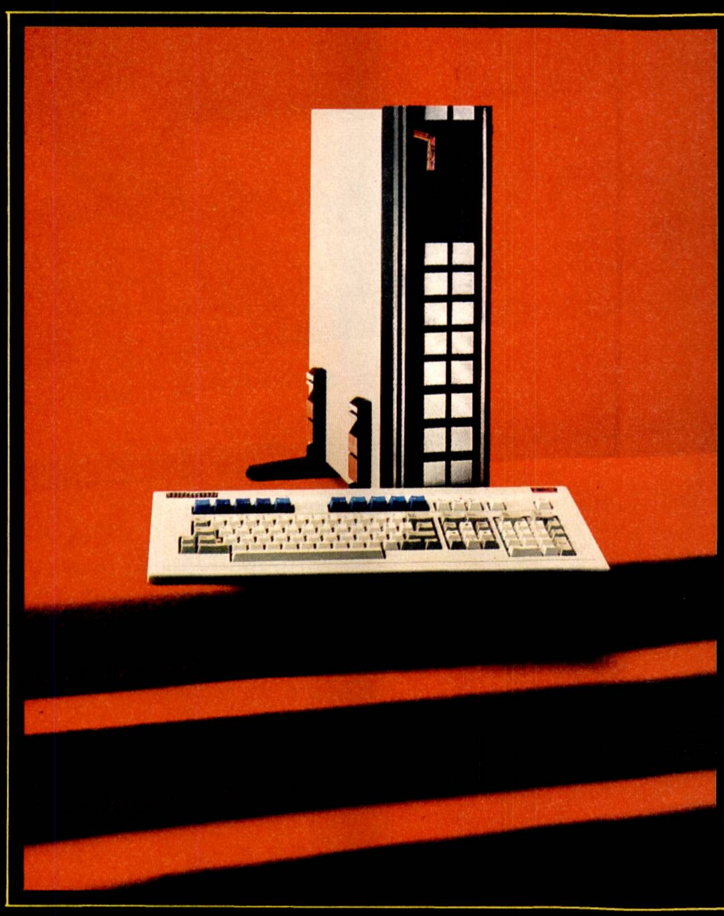

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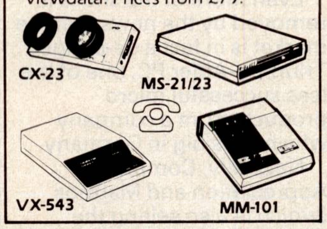

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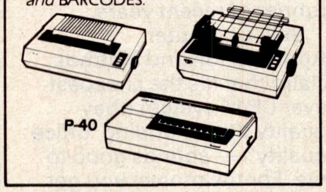

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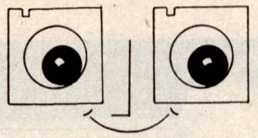

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NEWSPRINT

Apricot, having suffered heavy losses with the Portable, is depending on its new, 'secret' machine to help rectify its recent disappointment. Guy Kewney has the details of this, and other stories in this month's round-up.

Playing the Apricot game

It's no secret that Apricot is about to release its biggest Apricot micro ever, based on the Intel 80286 chip running unusually fast.

Well, it's no secret but the details are, because Apricot likes to play that kind of game. Although it's tempting to deduce that the machine can't be ready yet (or we'd have seen it), the logic doesn't quite follow.

Nonetheless, a lot depends on this new machine. Apricot isn't in financial trouble, but at the same time, it isn't doing well, either.

The problem is very simple. The company correctly spotted that there was a market for cheap 16-bit machines and announced a real bargain in the F1E, but failed to realise that this became a consumer item, not a business computer.

You have to sell that type of machine in different shops, and you have to sell a lot more — a very great many more — to make the same profit that you make on business machines. Apricot hasn't done this, and it has also caught a cold with its Portable, which has hardly sold at all.

With the new 'no wait states' machine running MS Windows, it may have a machine to challenge IBM in the corporate market, selling to executives in departments of large companies. But unless I'm badly misinformed, it doesn't have a machine to meet the challenge which Apple, Atari and Commodore are about to expose in the 68000 market.

Like anyone else working through Microsoft, including IBM, Apricot is going to use the 80286, say my sources, as if it were a fast 8088. That means no more than 640k of memory to a program, and the future is now very close indeed where people want to run two or three programs in 'pop-up' mode, each taking half a megabyte of store.

Meanwhile, Atari and the Commodore Amiga already go way beyond that, freeing software designers from memory limitations. And Apple still may wake up and put an expanded Mac on our desks before next summer.

Apricot is having to report profit drops, having earmarked £3m against stock of the Portable.

Readers with good memories are asked to forget which hardware award the Portable recently won, and are assured that I had nothing to do with it, am not a Freemason, and know of no other possible explanation.

The Portable, which seemed so wonderful when it was first announced, turned out to be unportable, to have a terrible display, and to have extreme difficulty in running Apricot software.

Apricot is entitled to a mistake or two. What it isn't entitled to, however, is a mistake plus a low-margin, low-volume 'success' during a time when it's trying to get started in the States.

Nothing I've heard from the States suggests that Apricot sales have been good. It was supposed to aim at a modest target of one per cent of the US market, and something special will have to happen if current sales are to rise to that level.

Hacked!

Don't try sending me messages on Prestel. Having published the ID at the end of this column for a few months, we suddenly found that this may have been a mistake.

Apart from the determinedly curious (or ignorant) individuals who persisted in trying to phone the ID by dialling the number (a waste of time, a robot will answer), there was also someone daft enough to get into the system and terminate the account. It's no big deal, technically, and only a beginner 'hacker' would think it worth trying. But if you don't have the talent or knowledge to hack a real computer system and leave no traces, I suppose the temptation to crack a public ID and crash it must seem glamorous. I don't know.

By next month I hope to have a new ID, which I'll publish here. My apologies to anyone who wrote me electronic letters on Prestel, but I can't read them and probably will never see them now. They have gone to that great write-only memory in the sky.

The same applies, unfortunately, to my Telecom Gold account. That remains the same, and I hope to be able to retrieve the most recent mail and reply to it soon.

Telecom Gold says someone asked them to 'devalidate' my account, so it did.

You can't keep some machines down

After the Amstrad CP/M word processor at £400 plus VAT, something of the shock is taken out of Computer Appreciation's announcement of a CP/M machine for £250.

Even more of the shock is removed by the news that the market is in fact a de-badged Triumph-Adler PC, one of the less successful micro products from a company which sells big in Germany.

Naturally, Computer Appreciation and Matmos (which is also selling the machine) have been sworn to silence about its origin. Those of us with long memories, though, instantly spotted the machine that holds the record as the slowest WordStar runner of recent years.

Still, Computer Appreciation and Matmos claim that it's the cheapest-ever CP/M system (they qualify this by adding 'office quality') — sounds good to me. For the money you get the box only, plus a single disk. With two disks the price rises to £347 (plus VAT), and green-screen Zenith monitors are available for £75 plus VAT.

The original Triumph-Adler PC cost £350 just for the box.

Computer Appreciation is now in Canterbury on (0227) 470512. Matmos is at 1 Church Street, Cuckfield RH17 5JZ.

For one machine only

Do not buy TeleWriter unless you are a thousand per cent convinced you will never need to run it on a different machine from the one you own today.

TeleWriter is a program for both word processing and communications, which recently had a good write-up here in *PCW*. The reviewer obviously asked for a version of the program to run on the machine on which the review would be done. Quite sensible.

I asked for a version to run on the IBM PC and one to run on the Apricot, so that I could compare them. I found nothing to complain about on the Apricot, so far; but when I plugged the disk into my Olivetti M24, it didn't work.

Checking with the manual, I found that it does state, clearly and flatly, that it will only run on the genuine IBM. Versions for other machines are available, say the authors.

I don't very often come across idiocy of quite this blatancy.

If you buy a machine to run IBM software, then naturally, when buying software, you go to the IBM shelves.

To get to the office with your new purchase and then find you should have asked for the version for your particular IBM clone is merely irritating if the store is downstairs. If it's 50 miles away, it's a disaster. If you have two machines, one at work (genuine IBM) and one at home (cheap imitation) and you find you're expected to buy two versions, then you may have unkind words for the authors.

There's no technical reason why the program won't work on clones. The authors decided, in order to reduce the opportunities for free distribution, to include a software check for the IBM trademark in ROM.

I'm afraid they'll find they've reduced the opportunities for any kind of distribution, but most especially paid for. I might accept a pirate copy of this program, but I'd never spend my own money on something this restrictive.

A bitter blow

In the States, they are already getting Commodore models. The expected cries of delight are softer than I would have hoped.

Problems with the system software were to be expected, and Commodore did expect them, hence the decision to supply it all on disk rather than in ROM. But after all the excitement of the specifications, the reality has been a bitter blow to many users.

What worries me, however, is that the Amiga is failing to make an impression on software houses.

One Californian author, Dave Winer of Living Videotext, complained sadly that his attempts to put ThinkTank onto the Amiga had not been crowned with instant success.

'They've given us a development machine which doesn't work,' he said, 'and left us. When Apple first gave us a Macintosh, that didn't work either, but they also gave us five engineers. We're not getting that help with Amiga problems.'

Apple's decision to cut prices on the Macintosh, nicely timed, means that software houses which were thinking of giving the Amiga bandwagon a push will now think twice.

It becomes important, say software people, for Amiga to be at least as keen as Apple, and probably more so.

Further reports will reach you as I receive them.

Listening in

A computer magazine is no place to make a song and dance about Uncle Clive's new cellular phone at £99.95.

However, as the announcement is apparently imminent, and as Sinclair Research's fortunes are likely to take a distinct upturn when he announces the cheap device, I thought I'd leak it ahead of time.

It also gives me a chance to shed a little more light on the puzzle which I mentioned last month — the question of who was going to be managing director of Sinclair Research.

The current incumbent was not, definitely, the person Clive had hoped to hire. The question of who was actually in line was a mystery to me until a new magazine appeared on the market.

Richard Hease, founder and former boss of collapsed micro distributor Prism, has reappeared in the publishing business. His magazine is aimed exclusively at users of the Sinclair QL.

Gossip suggests that Clive's financial advisers were so hostile to the idea of appointing Hease as managing director, that the deal had to be called off even though agreements had reached an advanced state. In compensation (even though Hease hadn't planned it) the QL franchise was offered.

This kind of gossip is so often way off beam that I hesitate to suggest that it betrays much of the real truth, but when the industry is saying something behind closed doors and in pubs, I feel my readers are entitled to eavesdrop.

Tandy prices tumbling

The idea of selling Apricots through ACT's dealer chain has had one nice effect:

Pop music buffs will probably look harder at Feargal Sharkey (lead singer with the Undertones) on the left than at the Microvox digital sampler, now available from Supersoft.

The sampler can produce very, very clear sounds, fed into a Commodore 64 through a microphone, and editable, playable forwards and backwards and all sorts of other remarkable tricks — all for £230.

The device is the brainchild of Andrew Trott, the man on the right of the picture.

Details from Supersoft on (01) 861 1166.

★ ★ ★

Even if it had officially been at the PCW Show, the Amiga might still not have been the star turn as the Amstrad PCW 8256 really summarised the feeling of optimism and excitement that many people found there.

Predictably, Commodore dismissed the Amstrad as 'unlikely to sell well' because it made the Commodore 128 look foolish.

That wasn't the reason given, of course. The official explanation, from the mouth of Nick Bessey (boss of Commodore UK) was that the Amstrad wasn't going out 'through the dealer channel', and so wouldn't receive the 'essential support' that customers needed.

I assume this means that, if you went back to Dixons with a complaint about the Amstrad manual, everyone would shrug their shoulders. However, if you went back to Dixons with a Commodore 128 and some confusion about whether you needed C64 disks or CP/M disks, and how could you transfer files, they'd leap to attention so fast that all your friends, impressed out of their skulls, would fork out nearly double the price of the Amstrad to buy the 128.

This, in spite of the problems of buying tape drives, disk drives, printer and screen (and software) for the 128.

Bessey told me that a comparable 128 (with disk, printer and screen) would sell for just over £500. He obviously knows more about the future prices of disks, screens and printers than I do.

★ ★ ★

You may have noticed that ICL sells a device called a One Per Desk, loosely based on the Sinclair QL.

It has won an award.

Simple tact prevented me from writing too much here about the British Microcomputing awards back in May. The publishers of PCW sponsored it, after all, and they seemed to enjoy it, but I did think some of the awards were rather strange.

My response to those awards was as nothing to my astonishment when, at the PCW Show, I saw my old friend and colleague Tony Hilton (a journalist I used to know before he became City Editor of the London Standard) stand up and announce the Standard Hardware Awards of the Year, and name the One Per Desk as the winner.

Anything ICL adds to its approved product range, of course, will sell. I suspect that when it sells a mainframe, there is a checklist of other ICL products that 'go with it' and you are asked to approve how many you get.

You may recall a device called the DRS-20, which ICL sold as an 'intelligent terminal' and which had a Zilog Z80 in it. Theoretically, this could run CP/M.

The fact that it took four minutes just to load CP/M off the distributed network sensibly dissuaded most buyers from running CP/M. It didn't stop ICL from claiming, at one stage, that it had supplied more CP/M micros than anyone else in Europe, and it did sell a lot of DRS-20s to its captive mainframe customers.

Perhaps no-one told the Standard judges this.

At the official lunch at Olympia, when the announcement was made, the audience was very polite, and didn't cough and splutter. Had just one guest lost his control, I think we all would.

Many are the people I've approached with the news of this award, and I've asked them for an official comment. Without exception, they've made a tactful refusal to go on the record with any quote of substance.

Then, to a man and to a woman, a frown has crossed their faces and they have said: 'Who were the judges?'

For your own amusement, try the following Basic program on a One Per Desk or a Telecom Tonto:

```
10 for I = 1 to 1000 : print "*"
20 next I
```

On a BBC Micro I timed it at eight seconds. On Tonto, it took 172.

I'm sure I had a bad sample.

Tandy prices have tumbled.

As ACT Computerworld and Tandy now carry each other's stock, the Tandy 1000 has found occasion to drop £200 in price, down to £900, while the £2700 price of a hard disk Tandy 2000 is £500 less than it used to be.

Tandy says nothing about not wanting to look overpriced next to the Apricot. Instead, it talks about 'great success in world markets', and 'increase in manufacturing volumes', and 'unit costs' and 'the strength of sterling' — all of which is true, and has been true before without affecting Tandy prices.

But I'm not grumbling.

The Scottish question

There are a lot of products on the market calling themselves Logo which in fact don't behave much as that language should behave. Until recently this was a matter for irritation but not much more, as serious Logo users would dismiss these simple turtles out of hand.

Not all serious computer users know all that much about Logo, it seems.

A horrible chasm in time opened up last month, at the bottom of which could be seen a strange Basic-like language called Comal.

It was exposed when the Scottish education authorities chose this strange language as the standard for their courses in computing, and dismissed Logo, an obviously (I would have said) more suitable language, out of hand.

The move attracted the astonished eye of the new specialist magazine, *Logo User* ((01) 891 0989), and the editor invited Ken Johnson, of the Artificial Intelligence Applications Institute, who pioneered Logo in Britain in 1972 (I'm told) to explain why this was a poor idea.

Johnson's main concern, he says, is that the authority (the Joint Working Party on Computing Studies) doesn't merely defend its decision, but does actually reconsider.

'The reasons for dismissing Logo,' he says in his report, 'were given as "many versions offer only fixed loops; it does not offer data structures, and the range of numbers available is restricted".'

The IBM PC/AT has a hard disk, which you can't see inside. This picture shows the inside, which can only be opened up in a room with air so clean that even a smoke particle would feel conspicuous.

The newsworthy part of the picture is the fact that this clean room is in Havant, Hants, where IBM now makes its AT disks. Until this plant started to make them, IBM had to rely on sub-contractors, and problems with these suppliers have been the stuff of legend, even in the short life of the AT.

The hope is that, now, supplies of the AT will suddenly become easy.

As he correctly points out, all three observations are simply inaccurate. Worse, recursion (loops referring to themselves) is handled well by Logo (there are also loop instructions galore with REPEAT, but also with WHILE and DO . . . UNTIL, and even FOREVER, but when you get to Comal, you find recursion can't be done.

'When the BBC Micro first appeared, and (coincidentally) when Comal enjoyed its brief vogue, a number of turtle graphics packages came on the market,' commented Johnson. 'Some of them, little short of fraudulently, used the word Logo in their names.'

Johnson suggests that the working party may have been misled by this, as were other purchasers at the time. The question of data structures, he observes, is covered by Logo's ability to handle lists.

A list can be a sentence, a fraction, a matrix, a set, records, or even a program.

Johnson's article follows with an analysis of the pros and cons of Logo which I enjoyed and found instructive — and interesting. It's too late now to urge a rethink of the Scottish authorities, who made their final decision at the beginning of October, but the article might happily be recommended to other authorities to avoid this kind of problem.

The trouble is, unfortunately, that Comal has a lot of very worthy proponents who see it as the ultimate good, not to be queried.

The reason for this is simple: it is better than the type of Basic that was lying around when the BBC Micro was first designed. But, at the time, the authorities were all saying: 'We have to have Microsoft Basic for schools courses,' and Comal played a large part in providing improvements to Basic, which eventually appeared in the BBC Micro.

People who have taken up the cudgels in a fight like that tend to be very loyal to their champion, even after the reasons for that loyalty have passed. Come to that, people are loyal to their own computer languages, even if there is no reason for loyalty at all.

I expect the Scottish question will take some time to be resolved. I couldn't help noticing, in *Logo User*, a science fiction story which referred to some obsolete, twentieth-century languages.

The character in the story referred to them, only slightly inaccurately, as 'Bostic and Comic'.

Fault on the line

There is a flaw you won't have noticed in the new £400 Amstrad PCW8256. It mainly affects people with modems. If you want to use a computer with electronic mail, read on, carefully.

It has to do with the difference between CP/M files and Locoscript files, and there's a story behind it.

Do not imagine that, just because you have read everything written so far about the Amstrad PCW8256 (including last month's Benchtest in *PCW*) that you know all about it.

For example, the week it was announced, a normally reliable journalist wasted half a page of the weekly newspaper, *Computer Talk*, with a fascinating analysis of how clever Alan Sugar was.

The cleverness lay (so he wrote) not in producing a £400 CP/M computer, but in apparently producing a computer which would *only* do word processing. That was as far as he'd go in reading the press release, it seems.

The fact that the PCW8256 is a CP/M computer, capable of running most of the many thousands of CP/M programs on the market, including programs for CP/M Plus, totally escaped this commentator, and he proceeded to make a complete ass of himself by explaining how important it was that the PCW8256 could *not* be used for anything except word processing. And how he'd always predicted that this would happen, and everyone had laughed at him . . .

Anyway, in our Benchtest we remarked, in passing, that you could pass files from CP/M to Locoscript. That is true:

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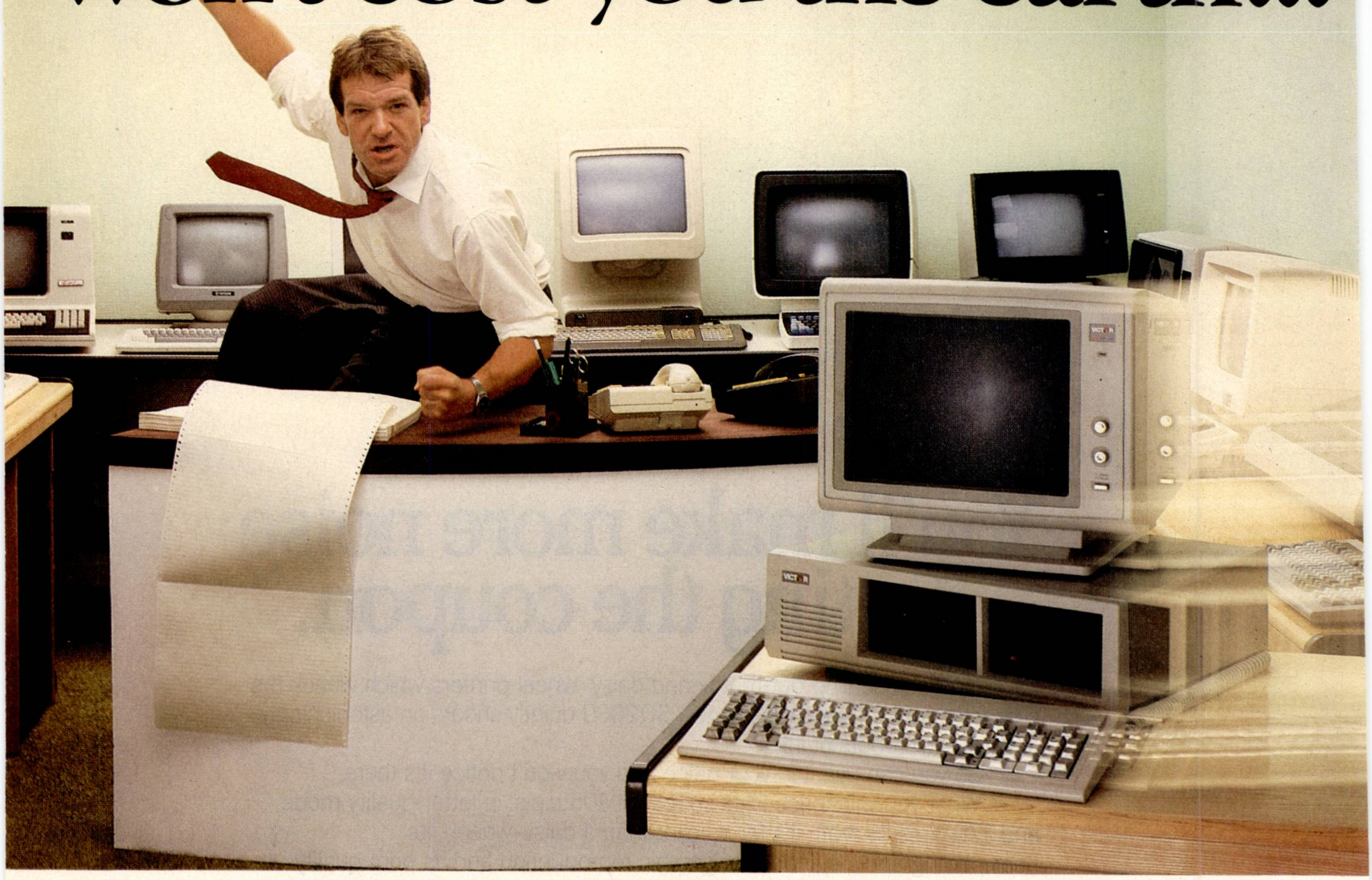

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P.C.W

LocoScript can read CP/M text files. Unfortunately we then added, as if it were obvious, 'and *vice versa*', and indeed it should be obvious, but it happens to be false.

If you spend £70 on the serial interface (availability? Don't know yet) and buy a modem, and some standard CP/M software to handle the modem, and plug your system into something like Telecom Gold (but preferably something that works), you will soon find yourself wanting to save phone time.

Most electronic mail users do this. They compose a letter, carefully, on a word processor. When they've thought about it and taken out the unkind reference to the recipient's morals, they save it on disk, log on to the e-mail system, and transmit it.

On the Amstrad PCW 8256, say my sources in Amstrad, this will not be possible unless you have another text editor, CP/M based, or until someone writes a program to convert Locoscript files to CP/M.

The reason it hasn't happened is simple: Amstrad drove a hard bargain with Locomotive Software and specified a lot of work, but didn't specify a conversion program. Locomotive reckons that if Amsoft wants it, then Amsoft can buy it. Alan Sugar, by contrast, reckons it's a necessary and implied part of the system, and Locomotive can supply it as part of the originally agreed deal.

In an emergency, I happen to know that Lion Microsystems' program, Comm, runs on CP/M, and does electronic mail at both 300 and 1200 baud. It includes its own editor, and while I've always found Comm a little confusing to use, it does work (quite reliably, too).

Lion didn't collapse with the associated company, Lion House retail.

A close look at this lady's face will show that the glasses she wears are apparently glassless.

The effect is achieved by 'coating' the lenses, in much the same way as photographic lenses are coated, to 'virtually eliminate' lens surface reflections.

The result is that more light reaches the eye (and less reflection reaches the camera), so people who wear glasses have an easier time reading computer screens.

The argument sounds plausible — certainly a lot more plausible than some highly suspect claims being touted by a firm (a different firm) which has released 'anti-radiation' mesh at over £200, designed to 'safeguard expectant mothers'.

The lens coating is called Quazar, from Balzers, which can be contacted on (04427) 2181.

The Japanese and lasers in print

You may have to wait a few months but it's coming — a £200 printer which will genuinely do better printing than a daisywheel, and will also do graphics and print at 200 characters per second, is already on Epson's catalogue for 1986.

Some people are having a lot of trouble believing this news, as they apparently can't see why Epson would want to make such a complex piece of technology for such a low price. 'It will ruin their existing market,' explain these sceptics.

There are two answers to this. The first is the warning that yes, it will ruin Epson's existing market, and it will also ruin everyone else's. There is bound to be a price war on existing printers, and worse, Japanese printer makers are now expected to dump their old stuff on Europe at fire-sale prices.

But the second part of the answer is that, really, Epson has no choice, and neither do the other major matrix printer people. As for the daisywheel people, their knell is now being rung.

In the States, the trend is obvious. In Europe, it's virtually invisible: a trend which shows low-cost laser printers taking over more and more of the top-quality print market for personal computers.

You may doubt that machines such as Hewlett-Packard's Laserjet and Apple's LaserWriter are selling well. According to the best UK information, only 3500 laser printers of all types, including Digital Equipment, Apple, HP and others, have sold — that's the total installed base.

In the States, something like 8000 HP Laserjets are sold each month, and almost 3500 Apple LaserWriters (costing nearly twice as much, at $7000) per month, too.

No daisywheel printer can compete with laser printer quality — just the print, never mind the graphics, nor the speed, nor silence.

However, the Japanese have always been ahead of the world on matrix printers. The reason is simple enough — the Kanji (Chinese characters) which are used in Japanese writing.

To do neat Kanji you can't manage with around nine needles on a matrix print head, and today's Japanese near-letter quality (NLQ) printers have 24 needles. As there are so many needles, they have to be very low-power or the head would burn the paper.

Citizen, a large supplier of matrix printers, is now believed to have dropped out of the Japanese matrix printer market — this belief is attributed to the company, Star, which makes them for Citizen. But Citizen is not dropping out of the market in the States or in Europe.

In the States, it has just announced a 15 per cent price cut. In Europe, it has announced a huge marketing and distribution franchise.

Other, similar moves have been reported to me by anxious printer dealers. One, looking for a replacement for his Silver Reed franchise, was approached by Seikosha (offering, he says, a 39-41 per cent dealer discount) without any undertaking about how many printers would be sold. That was the opening shot in negotiations, mind you, not the final-offer-take-it-or-leave-it-old-son. And whatever you may think of early Seikosha printers (which tended to be cheap for all-too-obvious reasons) the new range is as good as anything currently available.

The problem is simply and baldly stated: there are too many old matrix printers in stock. The printer makers overestimated demand for ordinary machines, but haven't adjusted production to match the reality. In this country, by press time, Epson hadn't even announced the RX85, already available in the States, due to the need to shift the RX80 stocks out of the warehouses.

Today, Epson sells a printer called the LQ1500. It's quiet, fast, and very good at printing. It costs well over £1000.

That same quality of printer, using new technology and without a few bells and whistles, is what Epson has lined up for mid-1986, and it will be sold direct to computer makers such as Amstrad, Commodore and Sinclair for $80. That means that it will be in the shops for £200 or less.

When that happens, you won't be able to sell an FX80 or RX85 for much over £50. Anyone making printers of that quality will have to shift the entire stock already lying around, plus any more that they make, before that happens. Which is just about everyone.

Which means one certainty. Even if the big Japanese don't go in for good old-fashioned 'dumping', you can be sure they will be accused of it.

The Irish solution?

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there are Macs;
- that in a year of 'slump', its sales are up 40 per cent to $140 million;
- that it has consistently foreseen technology trends, such as the laser printer boom which made clever printing fonts possible; and
- that after 10 years, it still finds it impossible to ship copies of software to me for evaluation until the need for them is past. I'd love to tell you about Windows, really I would, but a month after I sadly admitted that I couldn't get it to work, and that a new version was going to be supplied, I still don't have Windows . . .

Microsoft is opening a factory in Ireland to produce software. Let's hope this speeds up deliveries.

Selling the Stride super-micro (formerly the Sage) in this country, TDI now also sells the Pinnacle. That started last year, and has now been extended with the formal merger of Pinnacle, based in Dallas, Texas, and TDI, based in Bristol.

In the picture, the Texan, David Winstanley, is on the left, despite appearances, and the man on the right is the Bristol resident, Christopher Smith of TDI.

The hardware, in case you're curious, is Motorola 68000 based, and mainly uses Pascal, which is what TDI is very good at.

Details on (0272) 742796.

Lightning doesn't strike twice

Long ago and far away in the past, John Marshall set up a company called Nascom and launched a micro which set the UK micro industry on its head.

At the *PCW* Show, several of us older hacks, remembering those extraordinary times, compiled a list, with John Marshall at its head, of 'Where Are They Now' people. All we knew was that he'd set up a company called Gemini to make Nascom-compatible machines.

A week after the show, Marshall rang me up to say he was just launching a new micro. I got quite excited.

Then he told me about it.

It's a Motorola 68000-based system with CP/M 68k, Pascal p-System and BOS as three operating systems. You get a Wyse terminal and 512k of store, all for £5000.

John Marshall, for anyone who wants to know, is still at Gemini, and the phone number is (0494) 791010.

A Zenith by any other name

Mike Healy is backing the horse behind the Morrow Pivot — Zenith, and will be supplying the Zenith version of the machine in future. Included in the price will be a big, integrated software package called Integrated Seven.

The portable PC-similar machine looks rather like an old-fashioned portable typewriter, and was reviewed, with a couple of competitors, in *PCW*'s September issue. Confusion reigned at the time about who supplied it, who designed it, and whether some of these people might go bust.

At press time, Morrow still does make it, and so does Zenith, and both companies delight in telling little fibs about each other, so believe at most half of what they tell you.

Mike Healy used to sell Osborne machines (he used to be Osborne UK) until Osborne died. Now he sells the new Osbornes, and the Pivot is badged as the Encore Plus. It is, however, a Zenith Z-171.

The program that he supplies with it is new to me, and I hope to have more news next month. It also comes bundled with Healy's Spirit micro, with an XT equivalent (10Mbyte disk, 512k of memory, and Integrated Seven all included) selling for £1795. Watch his advertising for prices on the Encore Plus.

The program Twin, also sold by Healy, is a 'subset' of Integrated Seven. It is Lotus 1-2-3 compatible at the spreadsheet level, he says, and costs £145.

The machine is also imported, with the Morrow name on it, by Riva Terminals which reports that, despite interesting stories about banks and warehouses being emptied, and financial problems, and several other entertaining anecdotes being circulated in the industry, Morrow has no trouble supplying them, and has indeed just won a big US Government contract with the machine.

SuperScript for the UK

SuperScript is a UK-designed word processor for the Commodore 64, Apple II and Atari 800/130 ranges — machines with a 6502 processor chip inside.

WordStar is a family of word processors for machines using the Zilog Z80 or Intel 8086 families. MicroPro, the American writer of WordStar, has never had a program for the 6502 — or, it used not to.

Now, MicroPro has taken over UK marketing and distribution rights to SuperScript, and will sell it at £80 plus VAT. It remains the same product, and will continue to be sold by Precision software.

Under the carpet

Scepticism about 'office automation' is , apparently, rife among managers and directors of the UK's manufacturing firms. The Department of Trade and Industry is now spending nearly £400,000 trying to teach these people that office automation can be good for you.

What looks likely to be ignored is the question of whether it's good for your human colleagues.

A video, released by *TV Choice*, investigated the underside of the carpet in the nice, smart automation house, and found that questions of productivity, competitive edge, and all the other wonders which office automation can produce, often came at the expense of the people who operate the automatic machinery.

'Of the 350 people which the research team interviewed,' says the video production company, 'very few were prepared to appear on the video to voice their problems.'

Norman Thomas, producer of the video, says fear is the reason. 'Many staff believe their only route to promotion is through showing a keenness to use office automation, and so keep quiet about the problems they experience.'

Problems did include the famous 'radiation or some evil magic is causing birth defects' anxiety. For those of us who think that's an unreasonable fear, this video may provide some explanation of why it continues to be believed as workers with other, very tangible complaints obviously had them brushed aside.

'The screen was bright green, and to use it all day,

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Rest assured there is nothing clockwork or Mickey Mouse about Apricot's 'Gateway' computers.

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To begin with it's a businesslike 16-bit micro.

Given its low price, most of our competitors' offerings only give you 8-bits to play with.

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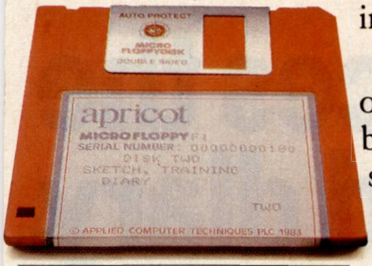
Every Apricot uses the advanced 3.5" disk pioneered by us and now rapidly becoming the industry standard.



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This includes a screen-based tutorial, an electronic diary, a sketch program, GW-Basic (GW stands for Gee Whiz which gives you some idea of its talents) and with the Apricot F1 and F1e, the addition of Activity.

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If you'd like more information about our 'Gateway' micro's call us on Freefone Apricot (via the operator) or send the coupon.

We'll send you a brochure as well as a factual comparison between us and our competitors.

It certainly puts the toys in their place, the games room.

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APRICOT F1, 256K RAM, SINGLE 720K DISK.

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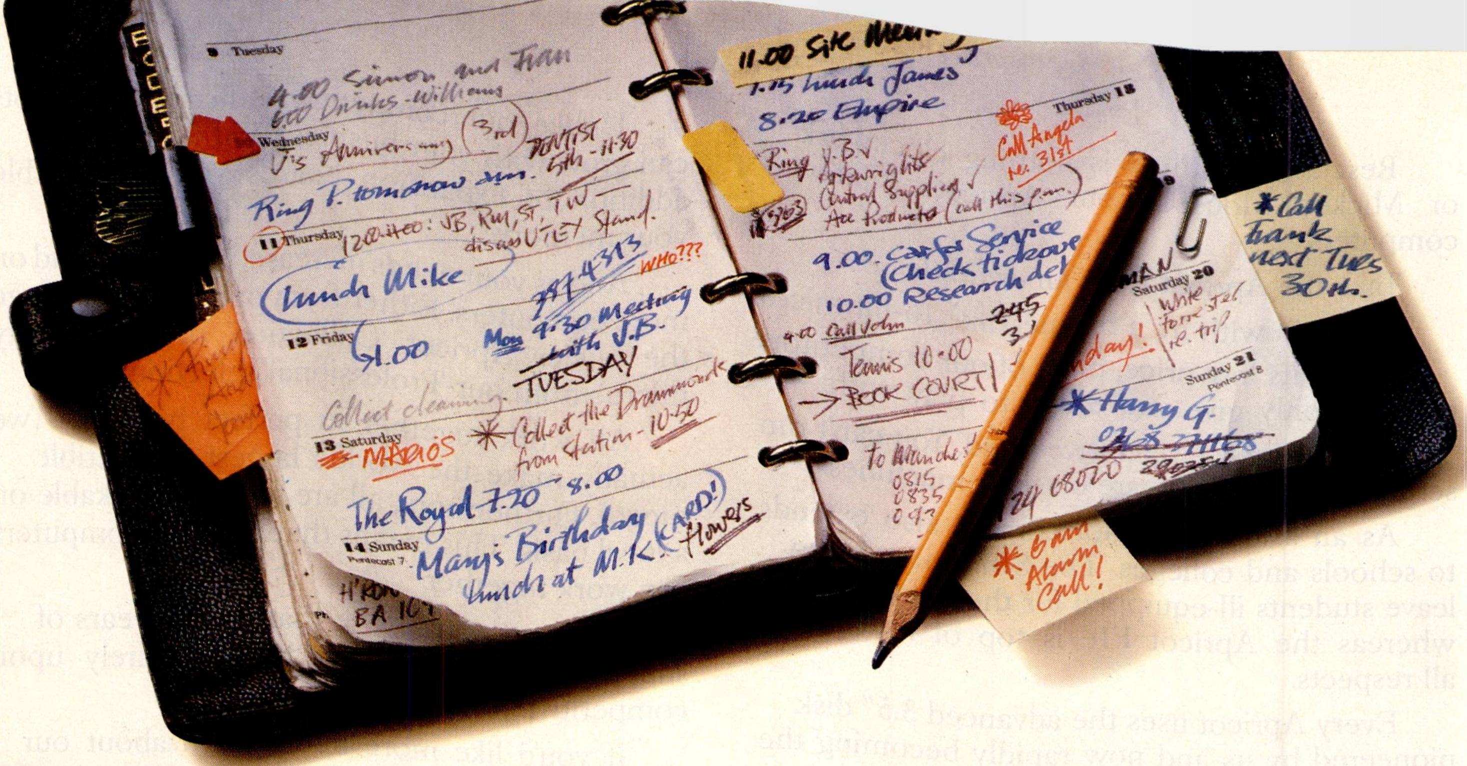

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Here's the new Seiko Wrist Memo Diary. It's the world's most advanced personal organiser. You wear it like a wristwatch. But showing the date and time is only one part of it.

Press a button, and it's a rolling month-ahead diary, helping you manage your busy life day by day. Meetings, flights, social engagements – all with a reminder alarm. Press again, and it's a multi-entry memo book: notes, phone contacts, sales figures, even your credit card and cash dispenser numbers. Now you're really organised!

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The unforgettable Seiko Memo Diary. The new high-tech way to organise your busy life. However did you manage without it?

SEIKO

WRIST INFORMATION SYSTEM

MEMO DIARY UC-3000

See the Seiko Memo Diary at all good electronic stockists.

some of the girls were having their colour sense knocked off balance. They were walking around seeing pink all the time. Everything was pink.'

The idea of productivity, too, turned out to be more of a stick to beat staff with than a carrot. 'If they've got something urgent they need doing, and you've been on the machine for three hours, they don't just say "can you do it" or ask if you need a rest. They just say "Do it."'

As it is obvious, to me, that office automation can be essential in making a manufacturing company competitive with overseas rivals, it is vital that people coming back from the TDI's courses see this video, too.

The TDI's job isn't to emphasise problems. It is probably in the business of a little surreptitious dirt-under-carpet work, if the truth were known, and something like this video is probably needed for balance in the approach to installing this bright, wonderful, green machinery.

Not a personal computer

Connex is not a personal computer: it's a portable telex machine.

It comes from Textlite Communications and costs approximately £500, plus rental costs of £25 per quarter, plus £45 installation costs, and apparently can be used from *any* telephone anywhere in the world to send or receive telexes.

As it's not a computer, I won't waste time explaining details — get them on (01) 631 0958.

Me and Miss Jones

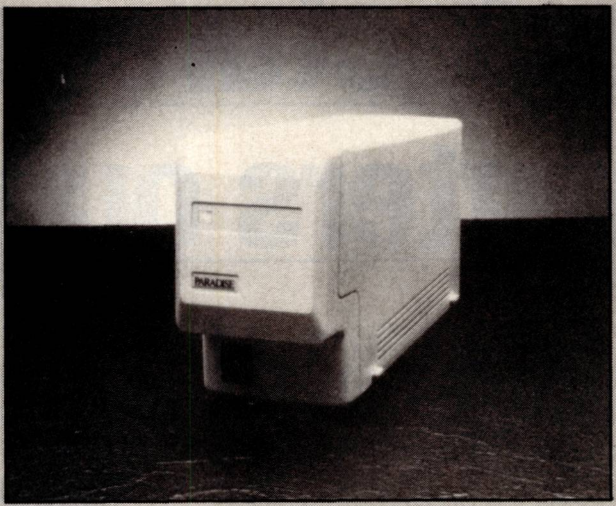
When running a program on an IBM PC, you can't use the machine for things like fast printing (or printing at all, mostly) and you certainly can't control things like headings and footers. Miss Jones, however, can.

Naturally, I expect to find flaws in Miss Jones when I finally get to test it, but on paper, this £50 program for the IBM PC looks so enticing that I couldn't resist mentioning it before getting hands-on experience.

It's designed to 'provide productivity and convenience benefits to any PC, AT or compatible user,' says Calibre Technology.

Speed quoted by Calibre: a typical Lotus 1-2-3 spreadsheet page requires a six-second pause to print, instead of the normal two minutes. And it does give control of headers, page numbers, margins and typefaces, it says.

The program can be started up from inside 'any application program', says my blurb. Tel: (088385) 2024.



The best-regarded hard disk for the Macintosh is the HyperDrive, designed by General, but as it goes inside the box, people are often shy of buying it.

The problem of having to send off your Mac to the States is now ended, with P&P Microsystems supplying the system, through agents, in this country for around £2000.

News from the States suggests that the company may now be bought by Apple, which will therefore adopt the Hyperdrive. And the 20Mbyte version is now available, too — no price in the UK, so far.

For those who prefer to put an external drive next to the Mac, the Paradise design from Accent must be the prettiest. The neatest, so far, is Mac Bottom, for which I don't have a UK agent yet; this one goes underneath.

Paradise has gone for Mac-alike design, 10Mbytes of storage and an extra serial port, normally lost when you plug in a disk.

Details from Accent Computers on (0444) 412334.

Spectrum art

One of the surprises of the *PCW* Show was a program for the Spectrum which performed just like MacPaint on the Macintosh.

There were several drawing packages for the Spectrum at the Show, but the one which caught my eye was the OCP package at £13 from Art Studio.

With the new Kempston mouse plugged in, the program really makes the Z80 chip sing. It has all the pull-down menus you know from the Mac, all the drawing commands you've seen on MacPaint, and the only thing that gave away the fact that this was a Spectrum was the colour. If you painted two areas in different colours, any third colour changed the large character-sized screen attribute areas.

It works off cassette, but I'd recommend the mouse, soon to be announced, and a microdrive version.

Details on (0753) 888866.

If you want to get ahead, get a blitter

The chip which does a lot to make the Commodore Amiga special is the blitter, and a similar chip is on the way for the Atari 500ST.

So, at least, went the gossip among the many software houses on the Atari stand at the *PCW* Show.

A blitter is an invention of the Palo Alto Research Centre run by Zerox in Stanford, US. It has a simple function: it moves the contents of memory somewhere else.

The Amiga's blitter (or 'bimer' — bit image manipulator) works in parallel with the Motorola 68000 chip. I don't know what Atari's plan is in detail, but the rumour is specific: it refers to the Mind Set computer.

The Mind Set was a cult machine, without a big company to push it, and without the resources to go for price, and it failed, largely, to win buyers. But it had a blitter, and that chip, say my sources, is going to be in the big Atari.

I think it needs it, at Atari.

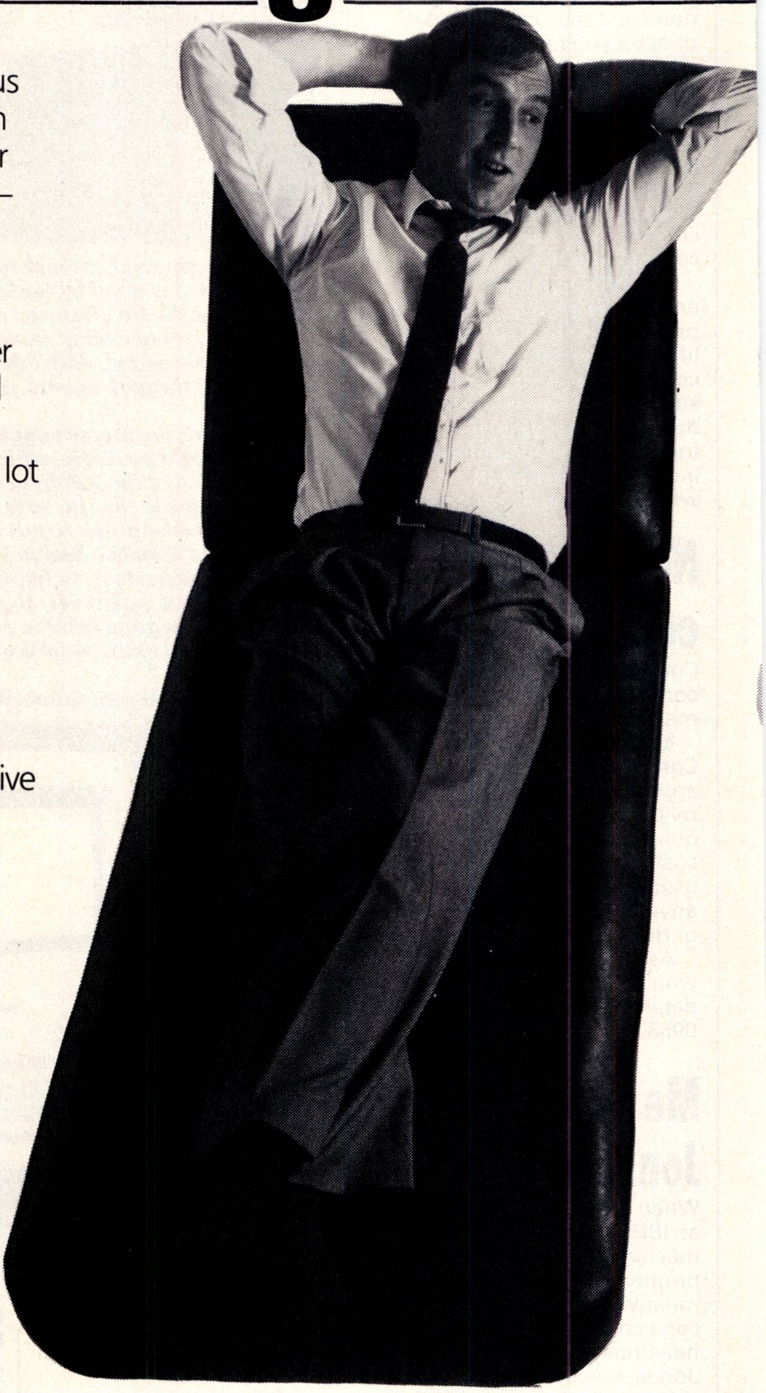
At a meeting of software writers before the Show, Jack Tramiel's son Len was approached by a group of programmers who expressed a lack of enthusiasm for the machine's disk.

'It's very slow,' they told him. 'It's a quarter of the speed of the Macintosh disk.'

He told them what they could do if they didn't like it. I believe they are considering that option — unless, of course, he offers them a new model just after Christmas, with a blitter. END

EPSON AT TRANSAM · EPSON AT TRAN

A manufacturer who rec
computers ought to be



If you think we're out of our minds, allow us to clarify the facts: it's precisely because Transam are manufacturers as well as specialist computer retailers, that we have the skill to spot a winner – from the inside out.

With our technical background, we're well placed to run a critical eye over competitors' developments, so you can be sure that whatever we stock has carved its way through our natural prejudice by sheer excellence.

Where customers are concerned, we do a lot of listening ourselves – before and after a sale. That's another factor that sets us apart as computer retailers, and makes our customer service an impressive talking-point.

Recently, we've put new developments in portable computers through our normal, deeply unfair tests, but even we have to admit that the capabilities of little machines like Epson's PX-8 give us plenty to talk about.

EPSON PX-8. THE FIRST TRULY PORTABLE BUSINESS COMPUTER

Weighing just 2.3kg, the PX-8 has a full keyboard and clear display, plus so many features it virtually puts your office at your fingertips – wherever you are.

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What's more, it's complete with four popular software programs and the world's most common operating system, so you can choose from hundreds of application programs to work for you – wherever you want to work.

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YANKEE DOODLES

Microsoft and IBM have signed a pact for the joint development of operating systems, and Commodore officials have been touting for dealers. David Ahl reports from the States.

A job well done

Microsoft and IBM have signed a long-term agreement for joint development of operating systems and other software. William Gates, chairman of Microsoft, said the companies planned to pursue software projects in networking, communications and a user interface, as well as continuing development of PC-DOS (MS-DOS). All products developed under the agreement would be licenced to both IBM and Microsoft. Microsoft would be free to remarket and licence the products to its other customers.

The agreement is 'long-term' without a specific ending date. No payments were made to Microsoft; rather, payment for each project will be negotiated separately. Under the agreement, long-term plans can be discussed more openly which should prevent the development of similar but incompatible products such as IBM's TopView and Microsoft's Windows.

Third-party software publishers and makers of IBM-compatible computers were pleased with the agreement as it appears to commit IBM to the 'open architecture' concept. Clone makers had been fearful that IBM would market a new, proprietary operating system that would cut them out of a lucrative market.

Financially, the agreement is a welcome one to Microsoft, which now gets about 10 per cent of its annual $140 million in revenue from IBM. Slightly less than half of the firm's revenue comes from the sale of system software and the balance from applications software. Microsoft had expected considerably more pay-off from its commitment to the Apple Macintosh. Bill Gates said: 'We once thought Macintosh would account for half of our retail application software sales, but that was based on the assumption that (Apple) would do a good job.'

Amiga defence

Reeling from tumbling sales and a $50 million inventory writedown, top officials from Commodore hit the road in August to drum up support for the Amiga.

Currently being delivered is the C128, replacement for the best-selling Commodore 64, but it isn't likely to match the latter's huge success. The 128 will be sold in approximately 10,000 mass merchandise stores in the US, one-third less than the 15,000 stores that handled the Commodore 64 at its peak.

Commodore officials are visiting 40 cities in an attempt to attract dealers for the Amiga; as of late August, only 260 dealers had signed. No deals have been reached with any major retail chains, although the Computer Factory, a 20-store New York based chain, has signed up. A Commodore spokesman said that deals with several major chains are 'imminent'.

Despite rave reviews in several magazines (including October's *PCW*), Commodore already seems to be on the defensive about the technically dazzling Amiga. Commodore spokesman Joe Thorsen cites its ability to run IBM PC programs with the addition of a $100 conversion program, but apologises that it will run 'a bit slowly'. He fails to mention that it also requires an external 5¼in disk drive. Why the emphasis on IBM PC software so soon? The Amiga is hardly a PC clone, and I can't imagine that PC compatibility should be a prime selling point.

Will the Amiga save Commodore? Not with marketing like this.

To fast to work

Ultra-fast transistors being developed at Cornell University may lead to fundamental revisions in computer architecture and integrated circuit design — and greatly expand communications capabilities.

Lester Eastman, professor at Cornell's School of Electrical Engineering, said that the switching times of these 'ballistic' transistors will be so fast (1.5 picoseconds) that other computer components will be unable to keep up and will have to be restructured.

Faster switching times are possible in ballistic devices as electrons pass through a very short length of semiconductor material almost without collision. The electron gains speed as it travels, just as a rock dropped from a bridge increases in velocity. Ballistic transistors can be made even faster by giving the electrons an initial boost — the equivalent of throwing the rock from the bridge — and by applying an electric field to keep the signal hurrying along.

'We have been able to reach speeds up to six times faster than those in conventional silicon structures by using layered hetero-junctions of gallium arsenide and other materials,' Eastman reports. These structures are made using machines capable of depositing materials only a few atomic layers thick.

Until computer circuits can be redesigned to take full advantage of the switching times of the new transistors, the slowest part of the process will be the transit time from one part of a circuit to another. Like racing cars roaring from the starting line into rush-hour traffic, the signals will come faster than the electrodes can move them. Although everyone wants faster computers, ballistic transistors may have to be deliberately slowed down to work.

Random bits

AT&T is eliminating 24,000 jobs from its Information Systems Division, the largest single lay-off in US business history. The firm blamed the lay-offs on the massive overlap in positions as a result of merging AT&T Technologies (formerly Western Electric) with AT&T Information Systems, but outside analysts also point to the weakening of the computer market . . . Commodore International also said it would lay off employees: 700 people are affected, about 15 per cent of its work-force . . . Earnings at DEC fell by 23 per cent on a 12 per cent increase in revenue in the quarter ended 30 June, while rival Data General reported an $8.3 million loss in the quarter . . . Also reporting a loss was the games software house Activision . . . In contrast, Compaq reported a five-fold increase in profits to $5.7 million in the quarter, credited in part to the firm's Deskpro and Portable 286 models introduced in April . . . Ashton-Tate recently acquired Multimate Int'l Corp, maker of a high-selling word processing package, for $19 million. The marriage makes good sense as the new company will have strong products in integrated, database and word processing software. It will also benefit from Multimate's strength in the corporate market, and Ashton-Tate's presence in retail stores . . . The Federal Communications Commission (FCC) staged a summer raid on Seequa Computer Corp, alleging that it was selling computers which violated FCC radio wave emission levels. The FCC referred over 20 criminal charges against Seequa executives to the US Attorney's Office in Baltimore . . . Steve Jobs has sold an 850,000 share of his Apple stock for about $13.8 million. After the sale Jobs is still Apple's largest shareholder with around six million shares, or 9.7 per cent of the company. Jobs has officially resigned as Apple chairman, and is setting up a new company to get into educational computing — where Apple is still the dominant force in the US. There are rumblings of future trouble, too, with the news that he is taking five leading Apple names with him . . . After soaring sales when it was introduced in June, Lotus Jazz (for the Macintosh) has largely fizzled out. Dealers mainly blame its slowness and clumsiness . . . Quote of the month: Philippe Kahn, president of Borland International, on the contrast between his success (based on selling good software cheaply) and the woes of other companies in the software industry: 'My competitors are just too greedy to make any money.' END

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Morse also stock for Apricot, Modems, Ram Boards, software and accessories.

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Morse are offering Sanyo MBC-555 dual disk computer with monitor, software (Wordstar, Calcstar, Datastar) and new Epson LX-80 NLQ printer and cable at £417 below RRP (£1412): **£995**
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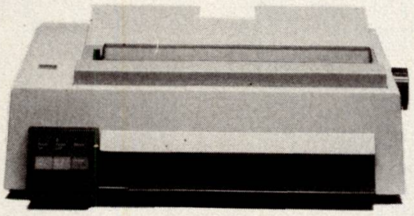

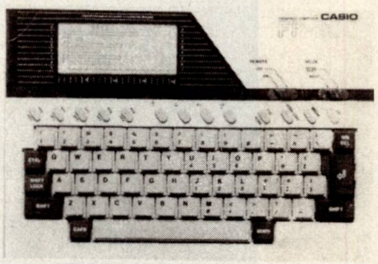

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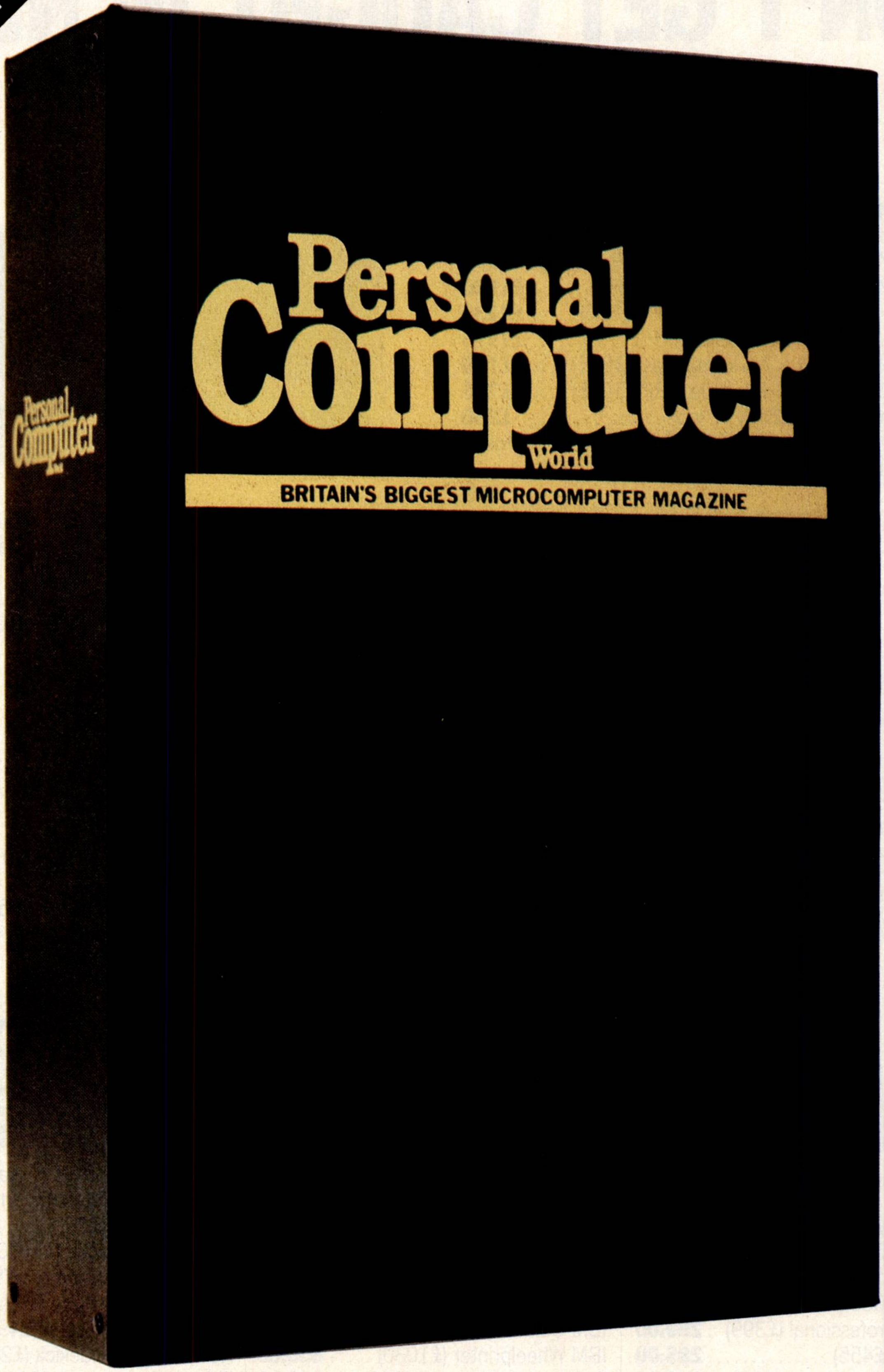
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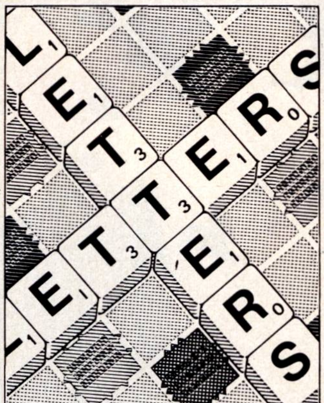


This is the chance to air your views — send your letters to Letters, Personal Computer World, 32-34 Broadwick St, London W1A 2HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

A destructive streak

May I warn your readers about a dangerous and undocumented feature of MS-DOS version 2.11 (probably other versions too, but I haven't been able to check them).

If you want to add one file to the end of another, you use the concatenation facility (copy file-1 + file-2). If all goes well, this gives you a new combined file called file-1, while leaving the old file-2 on disk.

There is, however, no way of creating such a new file and simultaneously deleting the old file-2. If the files are large, you have to make sure that you have enough free space on your disk for both the new combined file and the old file-2. But if you miscalculate the available space, MS-DOS will abort the operation and report 'insufficient disk space'. You will then find that it has destroyed the old file-1, and substituted an empty file with the same name.

This means that, if you want to add a 100k file-2 to a 300k file-1, but you only have 99k free on your disk, your 300k file will be irretrievably lost.

You might have thought that MS-DOS would restore the status quo before pulling out the plug, or that it would destroy file-2 to create space for the expanded file-1, or that it would write as much as the available space permitted — all these possibilities would allow you to rescue your text.

Instead, MS-DOS selects the most destructivee possible option and stupidly destroys an entire file.

When it comes to destroying valuable data, MS-DOS has few rivals.

Dermod Quirke, Strangled Vole Press, Newark, Notts

Small-business survey

We are an MSC-funded project that is preparing training material for the small business. This will take the form of some 300 half-hour units covering aspects such as starting up in business, financial control and marketing.

Some 20 to 30 of these units will be concerned with microtechnology. One part of these units will be used to help the small business determine whether a micro is a worthwhile addition, and if it is, the type of system it would need.

With this end in mind, we are carrying out a survey of businesses which have bought a micro in the last 12 to 18 months in order that we can pass on their experiences to any would-be buyers of small business systems.

I would be grateful if anyone willing to fill in the questionnaire connected with the survey would write to me at our address.

Robert I Pickering, North Wales Open Tech Small Business Unit, Connah's Quay, Deeside, Clwyd CH5 4BR

Zenith strikes back

The reason for this letter is to endeavour to correct a number of items in your September issue. The first is obviously a simple typo in that in the news story on page 110, the photo caption refers to our systems as being shipped with 25k! This should obviously be 256k except that the model pictured, our Z-200 Advanced PC, is shipped with 512k . . .

The rather more complex problems arise in your review of portable computers. While the reviewer, Guy Kewney, has captured the spirit of the thing most admirably, there are a number of points which are unclearly explained or inaccurate.

Firstly, Zenith Data Systems manufactures the Z-171 which is, indeed, a development of the original Morrow Pivot I/ Osborne Encore. However, Morrow buys its Pivot II, which is the Z-171 in a different case with some subtle changes in configuration and support documentation, from Zenith Data Systems. The machine is, regardless of its outer casing, a Zenith development, in conjunction with Morrow, of Morrow's original product that was itself a Vadem design. No wonder people are confused!

Secondly, the Zenith Z-171 product *does* have a viewing angle control which operates exactly as described for the Morrow version. Further, the Zenith product does support four levels of grey scale — as does the Morrow version. However, it should be pointed out in fairness that the Morrow grey-on-grey doesn't show up quite as well as the Zenith grey-on-turquoise, and is a feature that's quite easy to miss anyway as no-one *expects* to see a grey scale on an LCD!

Third, Zenith will not be producing an expansion unit for the Z-171, at least in the forseeable future. The reason is simple — cost. To expand beyond the box you need a case, internal metalwork, bus backplane and a power supply capable of driving several cards together with a Winchester disk. All that lot costs money, and as we forsee that the most likely need is for a Winchester disk on its own, it is more sensible to buy a commercially available drive with integral controller and link it to the bus via a ribbon cable. This approach works fine and is much more sensible and a good deal cheaper for the customer, at least in our view. Someone could, however, start up a nice line in external expansion units if they wished, as the bus is fully PC-compatible but has no internal power connections.

Fourth, the reviewer mentions that he would find a Hercules board essential — indeed, that appears to be his justification for the expansion box. Yet we offer, as he reports in his next paragraph, an internal RGB and monochrome (with grey-scale graphics) card to drive external monitors. Why does he need a Hercules card? Possibly to produce the IBM format high-resolution text mode — certainly for nothing else, and anyway, this somewhat defeats the portable concept. Zenith, sadly, will not be including the colour graphics interface as standard but as an option costing around £170. What Morrow's distributors are doing is not yet clear.

Fifth, the Zenith Z-171 will be supplied as standard with DOS 3.1 and 2.11 — we're moving with the times. Our system *does* include the telephone manager that the reviewer mentions in conjunction with the Morrow and the reason is simple: we are looking at getting a UK-approved modem for the Z-171 as soon as is humanly possible. My test sample Morrow Pivot II, by the way, came without a modem.

As a final item of interest, I understand from good American sources that if you type BOOT into a Datavue you'll find a strong Zenith flavour about that machine, too. I haven't yet had a chance to prove this, nor do I have any official explanation as to why, but it certainly sounds interesting.

Henry Budgett, Marketing Communications Executive, Zenith Data Systems

Guy Kewney replies: *I didn't expect Zenith to agree with all my opinions, and I don't agree with all of its points, either. On the expansion matter, users who have 'Hercules specific' software will understand my comments, and so will other people with plug-in hardware requirements. Meantime, we eagerly await the DOS 3.1 version for test.*

Average means

Your correspondent, Jason Shouler (*PCW*, August) considers that the geometric mean is 'the only meaningful

$$\log(GM) = \frac{\log(t1) + \log(t2) + \ldots + \log(tn)}{n}$$

Fig 1

way of "averaging" Benchmarks'. This is nonsense and the idea should be knocked on the head. Although there are several recognised methods for calculating a mean value of a given set of numbers, it does not follow that any one can logically substitute for another. If a large, random selection of n Benchmarks were run, one after the other, the total time taken would be approximately n multiplied by the arithmetic mean. The arithmetic mean is thus the 'expected' time for a randomly-chosen Benchmark test. It is the natural average to use because the total time taken by several Benchmark runs is equal to the sum of the individual times. The geometric mean, on the other hand, is calculated by multiplying all the times together and taking the nth root, where n is the number in the group. An example is shown in Fig 1.

There is no physical reality in the product of eight individual timings, and none in their eighth root either.

There is a further objection to the use of the geometric mean, even ignoring its illogicality, and this stems from the Benchmarks themselves. Computers were originally invented for numerical calculations, and ever since, the drive has been for bigger and faster 'number crunchers'. Most of the Benchmark programs are composed largely of integer arithmetic combined with loops. While interesting, they give hardly any indication of the ability of the computer to handle real (floating point) numbers. The geometric mean, though calculated in the same way for all machines, is always less than the arithmetic mean and is thus biased towards the shorter times and elementary arithmetic. This clearly makes things worse! It seems to me that more meaningful Benchmarks might be constructed from common numerical methods: for example, inverting a matrix, solving linear or differential equations, and so on. This would give a much better idea of the power of a computer than timing it spinning around practically empty FOR loops. The 'controversial' Benchmark 8 is, in fact, the best of the lot.

Finally, I would like to take issue with Jason Shouler about his comments on the 9.5 digit 'accuracy' (I think he means precision) of the BBC and Dragon micros. Both the QL and the Spectrum use exactly the same precision — that is, four bytes for the mantissa of a floating-point number, and I would be surprised if the Apple or the Amstrad used anything different. The QL, of course, prints only seven significant figures, but that's another story. One should, however, be careful not to equate length with accuracy. An article in *PCW* ('Fast Timing', Savic & Cabric, July) shows that the Apple is not so accurate as the others in the test group, and I know that some of the Atari and Tandy machines are also poor. It seems that some of the floating-point routines are more equal than others, literally. Short-cuts are taken, usually in the division routines which tend to be rather lengthy.

There is possibly a crumb of comfort here for readers who own or use micros which are commonly thought to be slow. When the result does eventually appear, there's a good chance that it's right!

Kenneth J Vines, Hale, Cheshire

BLUDNERS

In the Free Memory Display utility in TJ's Workshop, *PCW* September, there were a few errors.

The program as listed gave only the figure for memory of the program itself, not the variables used in the program. To modify the program so that the true value is printed, change the two numbers 18 and 19 after 229 to 2 and 3 respectively. Line 210 should then read:

```
210 DATA115,56,165,6,229,
    2,133,112,165,7,229,3,133,
    113,160,19
```

The checksum in line 100 becomes 13875.

This change makes the program use the address at 2,3 which points to the top of the variables. The program only works in mode seven.

No response

I had an Amstrad CPC464 which I used mainly for word processing with my Brother typewriter, model CE-60.

Two weeks ago I replaced my computer with the new model CPC664 — disaster! The typewriter does not respond to the new Amstrad.

Compumac, Amstrad's representative in Athens could not help, and indeed it was very much surprised and perplexed with my finding and the subsequent discovery of its cause.

Pin 9 of the printer port in the 464 corresponds to D7 (the eighth data line, D0 being the first) whereas in the 664 this pin is grounded and the D7 line does not exist on the new Amstrad printer port (see chapter seven, page 41 of the 664 manual and compare with appendix V, page three of the 464 manual).

I hope that Amstrad is in a position to provide an immediate solution to this problem, otherwise I cannot avoid comparing Amstrad with Sinclair.

Yannis Konstantatos, Attiki, Greece

Backing the Microdrive

It seems to me lately that Sr Clive's Microdrives are getting a raw deal as mass data storage devices for the Spectrum — nasty words like 'unreliable', 'slow' and 'notorious' are being tossed around, but unfortunately hard facts are thin on the ground.

OK, so the company isn't perfect, but what is? I mean, 'unreliable'? In the last 12 months I have accessed my eight cartridges more than 2500 times while finding that last bug in my world-beating programs, and have had Microdrive errors on only about 10 occasions, which I believe is pretty good. I've never failed to load a program on the second attempt, never had to reformat a cartridge since being put into use, and never failed to verify data.

As for speed, the excellent Tasword 2, (about 8k of Basic and 10.5k of machine code) loads in 10 to 15 seconds, comparable to a Tandy Model III business micro with disk drives, for instance, and a Quantum Leap faster than the Commodore 1541 disk drive costing four times the price. And 'notorious'? — I don't believe that Microdrives have actually killed anyone — yet!

Of course, I would agree that Microdrives have a few minor faults — the lack of a detailed directory is a handicap, and storage of information in data files could be better (no random access, and lengthy loading and saving, probably due to the slow interpretation of the appropriate Basic statements by the Spectrum ROM). However, they are unbeatable value for money, even now, when the competition has had 18 months to catch up.

I am certainly not alone in my satisfaction with Microdrives — two friends of mine are similarly very pleased with them, and judging by the high demand for cartridges in shops in this area, many others are, too.

JG Williams, Malvern, Worcs

Cobol defence

The information given to Mr Bawa of Streatham was factually incorrect, and your advice was misleading (*PCW*, September).

RM/Cobol contains a cross-compilation facility which enables applications written and compiled on one machine to be executed *without recompilation* on different machines (for example, between CP/M-80/MS-DOS/Xenix, Z80/8088/80286, single-user/multi-user, and so on). This is because independent intermediate code is generated by the compiler, and this is translated to specific machine code by the run-time module. RM/Cobol run-time modules are available separately, at a lower cost than the full system.

Several dealers stock RM/Cobol and are listed in a directory published twice yearly, available free of charge from Ryan-McFarland Corporation.

RM/Cobol is a certified Ansi-74 Cobol that has some popular extensions to the standard, but none that could be described as 'obscure features', and it would seem ridiculous to recommend that any programmer who is satisfied with his Cobol compiler should spend considerable effort rewriting source code.

I wonder what you would recommend if Mr Bawa subsequently wishes to run his Cobol programs under Xenix on an 80286-based machine?

Barbara Primrose, Manager, Marketing & Support — Europe, Ryan McFarland Corporation

END

Epson announces an absolute jewel of an icon system for IBM's PC that's more than just any old gem.

Taxi from Epson makes your IBM PC (and all true compatibles) as easy to use as Apple's Macintosh. But unlike another well-known icon system, everything you need comes in one box. Buy it, put it in, run it. That's all.

Once you've bought Taxi, you'll find not only is it easy to get working, it's also much nicer to work with. It must be said that the quality of the icon drawings is very high, certainly much better than GEM on the IBM PC (and before anyone dips their pens in vitriol, that last sentence isn't ours; it's Peter Bright's from July's PCW. As are the next two paragraphs in their entirety).

Taxi differs from GEM in that GEM stops as soon as you call an applications program. It doesn't matter how friendly GEM is, if you run with WordStar you are stuck with the WordStar commands.

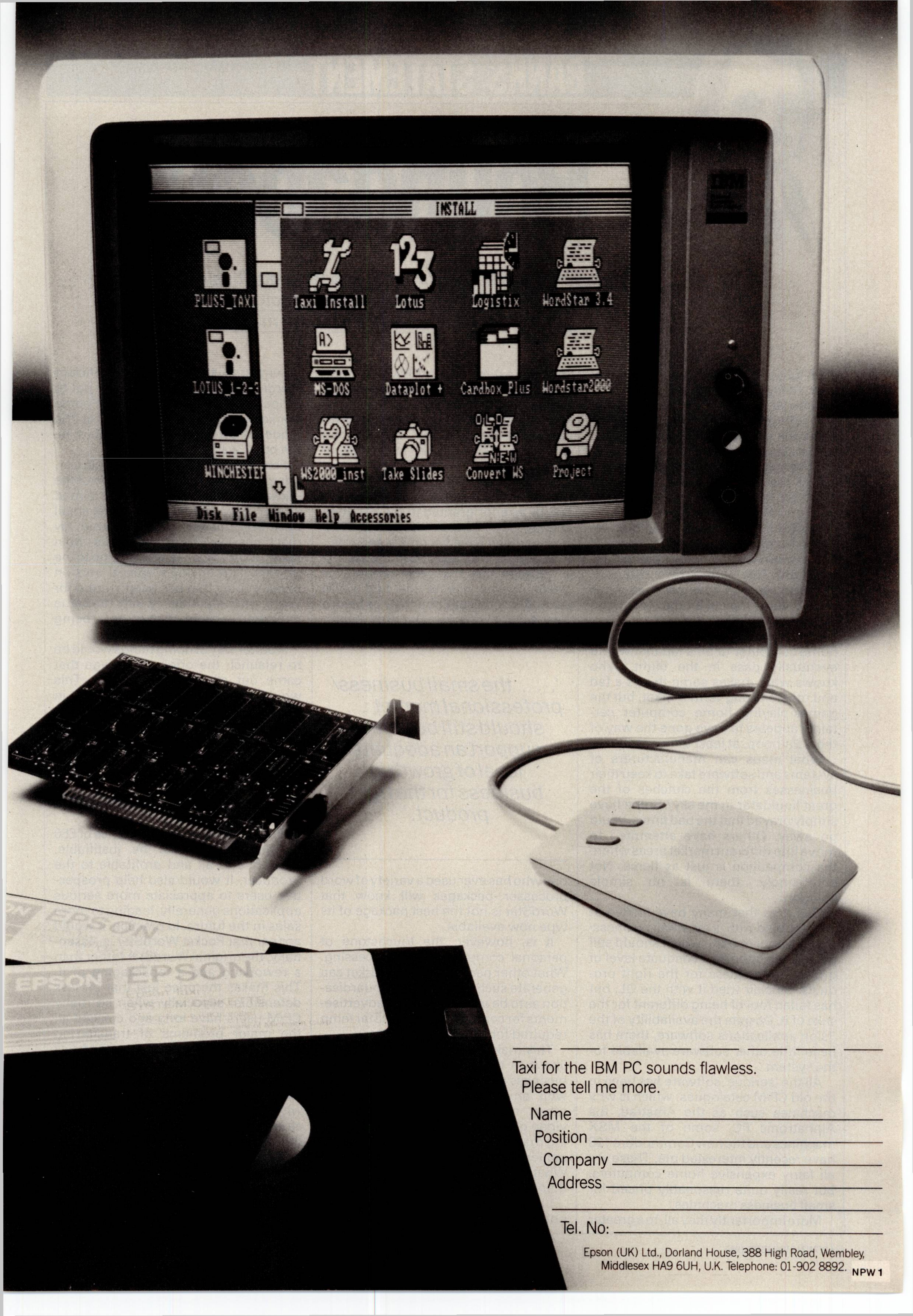
Taxi is different in that it goes some way in allowing you to modify standard applications programs. This is possible because part of Taxi is co-resident, it stays in memory when you load the applications program. This allows Taxi to exercise some control over the applications program while it is running.

Talking of memory, Taxi has another advantage that GEM's makers would rather you forget: 64K of memory built in. This means that Taxi takes up none of your IBM PC's memory. GEM, however, takes 128K; if you're trying to do large spreadsheets with Lotus Symphony (for example), you won't get too far — GEM's taken up a lot of the memory.

Furthermore, remember in the first paragraph we told you Taxi comes complete? GEM doesn't. In addition to GEM you'll probably need Sidekick. Next, you need a mouse. Oh, you might need some memory boards too. Then you'll need a rest (it's all that running around).

Epson, however, has made all the running, so you can relax. If you want to turn your PC into a Mac quickly and easily, buy Taxi. And at just £199 (+ VAT) there's another facet you'll never find in a gem.

Epson Taxi is a registered trademark of Epson (UK) Ltd. Other computer and software names are tradenames and/or trademarks of their respective manufacturers.



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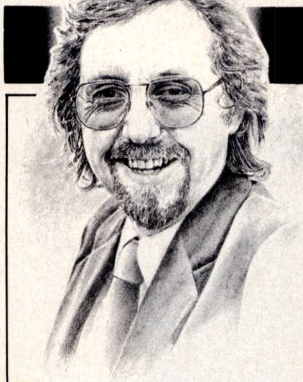

Roundabout

Martin Banks suggests a move to the small business market with CP/M machines for those manufacturers floundering in the demise of the home market.

Just what does the home computer user really want? This is a question which a large number of manufacturers and software producers would love to know the answer to. They have spent the last couple of years making a small (and sometimes not so small) fortune out of the home computer business, and now they are watching the gravy train grind inexorably to a halt.

The home market has been built on cheap hardware designed primarily, if not exclusively, for video games applications. This is where the customers' interests seem to have been, so it has been entirely logical for the industry to bust a gut satisfying it.

It has also been fairly logical for the home computer to be a fad that would eventually pass in the night. Who knows what makes some things a fad and others a long-term market, but the games-playing home computer certainly appears to have gone the way of the hula-hoop, at least temporarily.

What steps can manufacturers of systems and software take to keep their businesses from the clutches of the great liquidator in the sky? Some have simply prayed that the bad times would go away. Others have attempted to move into different market areas where the competition is just as fierce. Not surprisingly, there is no simple solution.

One area that many have looked at and dabbled with is the small business/professional market, which should still be able to support an adequate level of growth in business for the right products. Sinclair tried it with the QL, but has fallen foul of being different for the sake of it. Despite the availability of the Psion applications software, there has been little other software available for the system.

All the 'serious' software has been in the old CP/M catalogues, which is why machines such as the Amstrad, the Alphatronic PC, some of the MSX machines and the new Commodore 128 have recently interested me. These are all fairly expensive home computers, but really quite reasonably priced for small business machines.

More importantly they all, to a greater or lesser extent, run the CP/M operating system, where many years' worth of applications software has accumulated. Much of this software is rubbish, it has to be admitted. But a good proportion is the meat and drink of small business administration and management. The majority of the business applications packages which we all take for granted in the PC clone market now, started life in the CP/M arena; many have become standards.

WordStar is a classic example. Here is a package that has been around for years. It was one of the first CP/M packaged applications and it has been a best-seller ever since. But now, everyone who has ever used a variety of word processor packages will know that WordStar is not the best package of its type now available.

'. . . the small business/professional market . . . should still be able to support an adequate level of growth in business for the right product.'

It is, however, the touchstone of personal computer word processing. What other package on the market can generate such a degree of standardisation as to be referred to in job advertisements for copy typists: 'WordStar temp required for three weeks.'

This makes the package, and others like it, a natural target for the small business user as well as the home user with any interest in learning about other, more 'real' applications than video games. It also poses an interesting marketing conundrum for the companies which produce these packages. What price should they charge for them?

I usually lean towards the idea that prices should drift upwards rather than downwards, so that there is sufficient margin in the distributor/dealer pot to properly support end-users. The home market is one where I feel that the tendency can, and perhaps should, be the other way round, however.

For example, WordStar's producer, Micropro, has released a version of the package called Pocket WordStar, aimed at the new home/professional/small business market being created by machines like the Amstrad. Its main failing is the price — £149. Why go to the trouble of producing a 'special' version of something that has been around for years, running under exactly the same operating system that is now being used by the new owners?

A better way of doing things would be to relaunch the original package that came out all those years ago. This would be giving Micropro what, in marketing terms, would be called a 'geriatric kicker' to the package by generating revenue from the version that was long dead and paid for. Virtually any margin over the cost of production and marketing of this original version would be pennies in the till.

On this basis, an end-user price of £50 or even less would be justifiable, economic to all and profitable to the producer. It would also help prospective users to appreciate more serious applications generally, leading to more sales in the future. In practice, it would appear that Pocket WordStar is, essentially, the original WordStar rather than a reworking and a repackaging of it. This makes the price just that bit less defensible, especially when so many CP/M users have long ago cracked all the major problems of transferring copies of programs from one CP/M disk format to another.

I'm not accusing CP/Mers of being software pirates: they don't need to be with so much applications software already available in the public domain. But the difference between £149 and, say, £49 could prove just enough to make some of those long-term users offer their new coenvironmentalists in the CP/M world a . . . what shall we call it . . . helping hand? END

Illustration by Eddi Gornall

RISCy business

The Reduced Instruction Set Processor (RISC) era has begun, albeit quietly, and working examples are now appearing on the market. Dick Pountain examines three such processors, not least of which is the ARM from Acorn, a company which has kept this particular light well-hidden during its recently stormy times.

What exactly is a RISC, and why is it a good thing? A reduced instruction set processor, as the name suggests, is one which can execute only a small number of different instructions, compared to the prevailing standards of the day. In computing (as indeed in most walks of life) everything is a trade-off. A RISC processor trades off the number of instructions available to the programmer for speed; RISC processors can execute many times faster than their more complex brethren. When implemented as microprocessors in silicon, RISC designs also save precious space on the chip; smaller chips can be designed and debugged more quickly and cost less to fabricate.

The usual trade-off is code size. By having fewer instructions and fancy addressing modes, RISCs often require more bytes of code to do the same job. As memory continues to plummet in price, many people will come to find this an eminently sensible trade-off. And as I shall explain when discussing two other RISC systems (the Inmos Transputer and a machine based on the Forth language), the trade-off isn't even inevitable.

As early as 1975, IBM began a research project on the 801 minicomputer which incorporated RISC ideas and is *rumoured* (remember this is IBM) to have been capable of 10 MIPS (million instructions per second), four times the speed of its 370 mainframe. The 801 research was spurred by studies of conventional computer architectures which suggested that the average processor spends most of its life executing a handful of simple instructions, mainly load, store, branch, add and subtract.

In the early 80's, student projects at Stanford and Berkeley universities in California led to designs for reduced instruction set chips which achieved performances that surprised the industry as well as their creators. For instance, the second Berkeley chip, RISC II, with an 8MHz clock runs integer arithmetic C programs faster than a 12MHz 68000 does.

Despite these promising pointers, the computer industry has until now continued along its traditional path, which is to produce a new-generation processor based on the old generation with more instructions added.

This drive for more and more instructions is not governed by any theoretical rationale. The original microprocessor instruction sets were designed in an *ad hoc* fashion by hardware engineers rather than programmers. They were in part copied from existing minicomputer designs such as Digital Equipment's PDP-11 and the IBM 360, and in part were decided by the pure practicalities of what could be done with the technology of the day (remember that all those chips represented the state of the art of their time).

The RISC approach

A RISC processor is stripped down, like a racing car, for speed, speed and more speed. More speed lets us use more civilised tools to get the job done quicker, more securely, and more reliably.

There is no single recipe for RISC processor design; the only thing which connects the three different approaches described in this article is that they all involve processors which can execute only a small number of instructions (from 40 to 70), and they can be implemented in a small amount of silicon (tens, rather than hundreds, of thousands of devices) From that point they diverge completely, with stack-based versus register-based architectures, threaded versus block structured code, high-level versus assembler style instructions.

Most current microprocessor designs are 'micro-coded': that is, the processor instructions are written in a lower-level code called micro-code. Micro-code is fixed at design stage and cannot be accessed by programmers. Each processor instruction is implemented by a micro-program which controls the switching of gates, and the sequencing and routing of data around the chip needed to execute the processor instruction. The micro-code itself is executed by the control unit on the chip, almost like a computer within a computer. A sizeable part of the silicon area is devoted to a ROM which holds the micro-code sequences.

The most immediate advantage of a reduced instruction set is that it reduces this space required for micro-code ROM (in the Acorn ARM it is reduced to nil, as the instructions are hard-wired with no underlying micro-code level at all). This allows the size of the chip to be reduced and hence the lengths of the data paths, which in itself leads to increased speed.

One factor which all the designs discussed here share is a concentration on high throughput by efficient pipelining of instructions. The speed of a RISC comes from making as many of the instructions as possible execute in a single machine cycle, and guaranteeing that the processor rarely has to wait for the next instruction to be fetched. By using techniques such as packing more than one instruction into a word, and overlapping in time the instruction fetch, decoding and operand manipulation, the processor is kept working as fast as the silicon will allow all the time.

The so-called 'Von Neumann bottleneck' (that is, the limited speed with which a processor can access its memory), is attacked by every trick in the book, and occasionally by rewriting the book. One approach, exemplified in the Berkeley RISC and at Acorn, is to use the silicon space freed by the small instruction set to have lots of registers (up to 64) so that more operations can be performed without memory access. The Forth machine on the other hand uses stacks, implemented in ultra-high speed RAM, to achieve the same effect.

The Acorn ARM

The recently announced ARM (Acorn RISC Machine) chip from Acorn was a very well-kept secret indeed. A design team at the Cambridge headquarters was set to work in the heady days before the financial near-collapse of 1985, in collaboration with the US firm VLSI Technology Inc which supplied the CAD workstations and is fabricating the

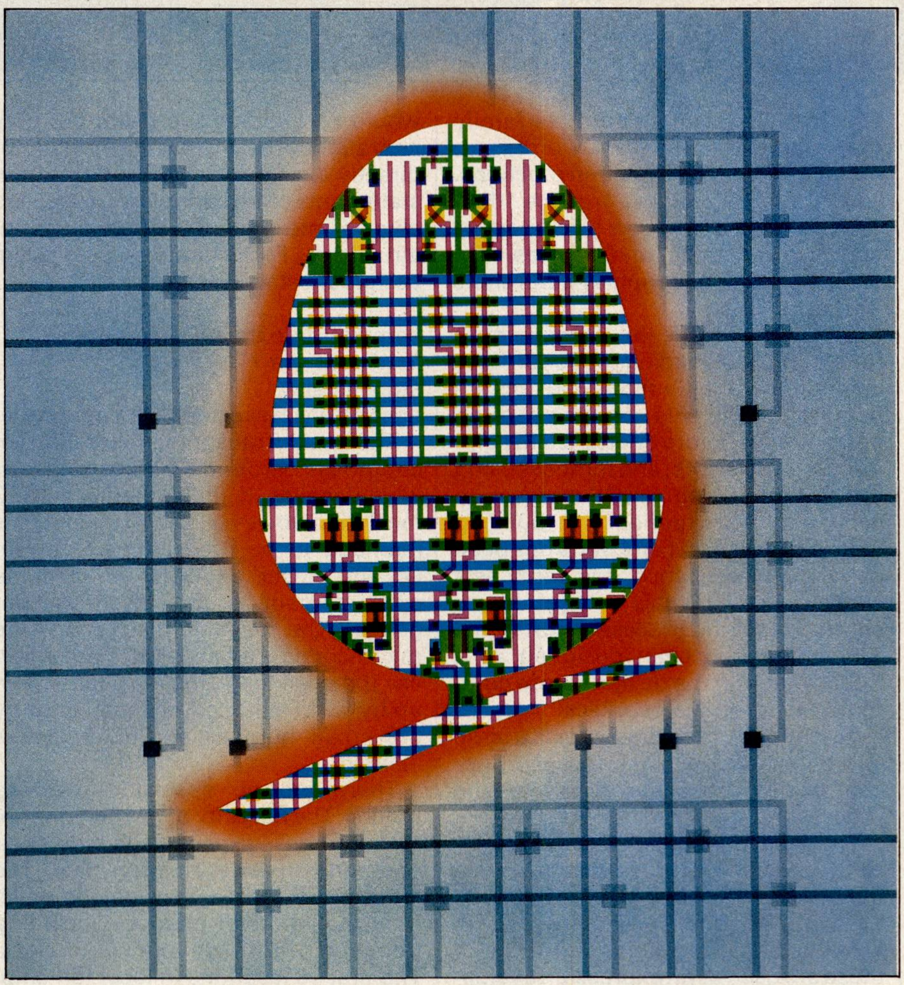

Illustration by Stuart McKay

chips. The Acorn team had experience of VLSI design from working on the ULAs for the BBC Micro, but none in processor design. In a remarkable 18 months they designed the ARM from scratch and it worked as specified at the first attempt, although they would be the first to admit that this triumph is as much due to the RISC design philosophy as to their own unquestionable skills.

The ARM chip is a product of Acorn's business division: it will certainly be incorporated into future computer products as well as sold to other manufacturers. So far, however, nothing specific has been announced, although the previously mentioned evaluation board which can be operated from a BBC Micro should be available soon.

The Acorn design team, headed by Steve Furber on the hardware and Roger Wilson on the software sides, were inspired as much by the venerable 6502 as by other RISC researchers. Working with the 6502 on the BBC Micro had convinced them of the virtues of this simple design, both in execution speed and in its unrivalled response time to interrupts (better than that of present 16-bit chips).

The ARM design started, quite properly, with the instruction set rather than the hardware. In fact the whole design, debugging and proving of the chip was performed on software simulations (some running on BBC Micros with the 3MHz 6502 second processor) with no hardware prototype at all. The first chips were also the first hardware realisation of the project!

The ARM is closer to the Berkeley model of RISC than the other two systems discussed here. It uses 25 registers and a highly pipelined architecture to achieve a performance of 3 MIPS from a small (7mm square) chip. It contains 25,000 transistors. For comparison, the Motorola 68020 is 9mm square, contains 192,000 transistors and achieves about 2.5 MIPS. Clocked at the equivalent of 5MHz, ARM runs the *PCW* Basic Benchmarks almost exactly 10 times faster than the IBM AT, and comfortably faster than the fastest machine in January's list, the TDI Pinnacle with its 12MHz 68000. Fabricated in a fairly conservative three-micron CMOS technology, it will be very much cheaper to manufacture than the 68000 series, and uses so little power that it doesn't become even detectably warm in use.

ARM has 32-bit registers and data bus, plus a 26-bit address bus which enables it to address 64Mbytes of memory on byte boundaries. There are 25 registers in all, only 16 of which are normally available to the programmer (some extra ones become available during interrupts). The program counter is kept in register 15, and holds the status flags in its first six bits, there being no separate flags register.

All the instructions are 32-bit words (aligned on word boundaries), divided into several fields, and can be fetched in one cycle. All operations are performed on 32-bit quantities, the load and store instructions being smart enough to extract bytes and zero extend them to 32-bits when required.

There are 44 basic instruction codes, which can be categorised into five types: load/store single registers, load/store multiple registers, arithmetic and logical, branch, and software interrupts. No multiply or divide instructions are supported.

All instructions are conditional: that is, they include a test which has to be true for them to be executed. The first four bits of each opcode are used to select one of 16 possible conditions. The purpose of this is to reduce the number of branches required in a program, as branches reduce the efficiency of pipelining. When a branch is taken, the next (already fetched and decoded) instructions have to be thrown away, causing a break or 'bubble' in the pipeline.

There are only two addressing modes, base-relative and PC-relative. These are made highly flexible by permitting a second register, shifted if required by an on-chip barrel shifter, to be used as the offset. The result of the offset operation may be optionally rewritten to the base register and combined with the use of negative offsets; which gives the equivalent of the 68000's pre and post auto-decrement and increment modes. The barrel shifter is also used for arithmetic and logic operations, and (without the programmer's involvement) to align data words and to extract fields from instructions.

Branches use a 24-bit offset which allows branching anywhere in memory. There are no separate long and short jumps, and no reason to want them as they would save neither space nor time. Setting an optional link bit in the branch instructions copies register 15, the program counter, into register 14 so that jumps and subroutine call/returns are catered for by the same basic instruction.

All the ARM instructions can be executed in one clock tick, except for the load/store multiple register instructions which require one tick per register. These latter instructions provide a fast way of saving the processor state, and allow very efficient context switching for procedure calls in high-level languages and for interrupt servicing. To enable the ARM to be used in virtual memory systems, all the instructions are restartable when the Memory Manager orders an abort.

As an example of the way these simple instructions can be exploited, a number in a register could be multiplied by 17 by adding it to itself shifted left four times, in a single clock tick.

The control of data flow through this pathway is not performed by a single control unit as in conventional processors, but through a number of separate functional units. The instruction decoder, for instance, is a programmable

logic array with the instructions all hard-wired; there is no micro-code ROM, as bits in the actual instruction word provide most of the control information. Condition sequencer and instruction skip units allow a fetched, decoded instruction to be skipped if its condition fails, without breaking the pipeline of following instructions.

An instruction may be fetched from memory while its predecessor is being decoded and *its* predecessor is still finishing execution in the ALU. This state of affairs persists as long as register-to-register operations are being performed consecutively without branching, and it maximises the throughput of the processor. (All the arithmetic and logic instructions are register-to-register). Acorn has measured ARM's maximum processor-to-memory bandwidth (the rate at which data can be transferred) as 18MHz, compared to 4MHz for the IBM AT, 2-4MHz for the Macintosh and 1.2MHz for the IBM PC. ARM has been designed to extract the most performance out of the cheap DRAMs currently used in personal computers, but could show even better performance with fast static memory parts.

The Inmos Transputer

Inmos' T414 Transputer, now coming off the fabrication lines in Wales after a delay due to process problems, is not usually thought of as a RISC machine. The Transputer is a radical design which can be used to construct parallel processing systems; it's a 'programmable component' rather than a central processing unit. Systems built from large numbers of Transputers will be used for applications such as graphics, digital signal processing and control systems, which require extremely high computing performance. A recently announced project aims to build a super-computer from Transputers.

In order to facilitate the building of parallel processing networks, the Transputer contains a complete computer on a single chip. Each T414 chip has a processor, 2k of memory and four serial communications links on the same piece of silicon. The on-chip RAM (the next model, T424, will have 4k) enables each Transputer to perform local processing, as well as addressing extended off-chip memory if required. The four high-speed serial links enable the different Transputers in a network to communicate with one another at 10 Mbits/second. The performance of a single chip is the range from five to 10 MIPS, depending upon the program material being executed.

The T414 is a 32-bit device with 32-bit registers and a 32-bit address bus capable of addressing four gigabytes of off-chip memory. The name Transputer, strictly speaking, refers to a family of designs, with different word sizes, numbers of links and built-in functions. Later, Inmos intends to produce 16-bit models (which save on silicon space and package pins), and devices with dedicated disk or graphics controllers on-chip.

Unlike the ARM, the Transputer is forced to use leading edge process technology. Simply fitting the components onto one chip requires packing densities not before attempted in commercial processors, and Inmos is using a sub two-micron CMOS process to achieve it: its experience in building high-performance RAM parts has been of valuable assistance. It is partly as a consequence of this critical space shortage that the processor part of the Transputer has been designed as a RISC (although the designers are committed to it for 'philosophical' reasons too). Although the Transputer is a large chip with many devices on it, only 25 per cent of this space is available for the processor part.

The Transputer displays a very different RISC architecture from that used in the ARM. Instead of a lot of registers, it has virtually none. To be more precise, it has only six registers, and three of these are used as an expression evaluation stack. The other three are called the Workspace Pointer, the Instruction Pointer (that is, program counter) and the Operand Register, and none of them is used to hold data. In place of data registers, the Transputer employs its on-chip RAM to hold operands; the Workspace Pointer points to the area of RAM which is currently being used as the register set.

This feature was determined by the need for the Transputer to execute multiple concurrent processes. Switching contexts, when one process is suspended and another is started, can be achieved by switching the contents of the Workspace Pointer to point to the new process's data area, and it is very efficient as few registers have to be saved. The on-chip static RAM is ultra-fast, as it does not suffer the delays normally encountered in driving the pins to get signals off one chip and onto another. It can cycle as fast as the processor (20MHz) so the overall effect is as if the processor had 500 32-bit registers, although of course they can hold either code or data.

The Transputer instruction set is designed to directly support the execution of a particular high-level language called Occam. Occam is a new language, designed by David May of Inmos and Professor Anthony Hoare, the Oxford computer scientist, and it's the first language to fully incorporate the concept of concurrent operations. It's a block-structured language which superficially resembles Pascal or C. It would be bending the truth, but only very slightly, to say that the Transputer directly executes Occam code. Occam statements often compile into one, and always into very few Transputer instructions. For example, the Occam assigment statement:

x := 1

compiles into the two instructions :

load constant 1

store local x

each of which executes in a single cycle.

The actual Transputer instruction set comprises around 60 instructions, which makes it indisputably a RISC machine. However, the Transputer is intended to be programmed only in Occam, never explicitly in machine code: Occam is its 'assembly language'. The machine instructions are micro-coded rather than hard-wired like those on the ARM, the space taken up by ROM being compensated for by the small number of CPU registers needed.

There are no special addressing modes. The majority of instructions are zero address, expecting to find their operands on the evaluation stack. The rest are one-address instructions which treat the whole of memory, including the on-chip RAM, as a continuous block. The first 16 locations in local (on-chip) memory are special cases which are addressed by single-byte instructions (for example, 'store local' previously mentioned). Array indexing and record addressing via pointers are performed by powerful single instructions rather than addressing modes. 32-bit multiply and divide instructions are provided.

Like ARM, the T414 Transputer uses a straight and uniform 32-bit data path which runs through all the registers and control blocks. It also pre-fetches instructions, but the pipelining is not quite so extended as in ARM due to the frequent process switches required when executing concurrent programs.

A very clever scheme of instruction encoding overcomes one of the disadvantages of RISC designs, namely the size of their machine code. All Transputer operation codes are one-byte long (this also has the immediate benefit that on a 32-bit T414, four instructions are fetched at a time).

As eight bits are not enough to encode all the possible op-code/operand combinations, longer instructions may be built up by stringing together sequences. After analysing typical programs, a frequency encoding scheme has been devised whereby the most commonly used instructions are only one byte long, and the least commonly used ones are the longest. This leads to a code density which is higher than that of first-generation microprocessors, and much better than newer processors like the 68000. For example, the two aforementioned in-

structions, load constant 1 and store local ×, are both single-byte codes.

The scheme works as follows. Each byte-long op-code contains two four-bit fields, holding the function code and a data value:

7	6	5	4	3	2	1	0	BIT
FUNCTION				DATA				

Four bits can only encode 16 functions, and 13 of these codes are used for the 13 most frequently needed instructions, including the arithmetic and logical operations, comparisons, and local load and stores. The other three function codes are used for the 'prefix' instructions, which say that the following operand consists of more than one byte, and the 'operate' instruction which does the same for instruction codes.

Prefixed instructions are built up in four-bit chunks in the Operand register by successive loading and shifting left. For example, the constant 897 hex would be loaded by:

	Operand register	Stack
prefix #8	8	
prefix #9	89	
load constant #7	->	897

which occupies three bytes and takes three cycles. This is not as time-inefficient as a naive first glance might suggest. Firstly, experience shows that the vast majority of constants used in programs are small integers like 0 and 1 (which would take one byte and one cycle). Secondly, the simplified instructions are so fast that you're still winning anyway. A roughly equivalent Z80 instruction such as LD HL,#897 takes 10 cycles. As for it being verbose to program, let the Occam compiler worry about that.

A powerful consequence of this scheme is that any instruction can take an operand of any size up to the word size of the processor, and more importantly, the code becomes independent of the processor word size. The same code will execute on a 16-bit and a 32-bit Transputer.

In summary, although the Transputer is more than a RISC, the RISC philosophy was crucial in enabling its more ambitious features to be realised within the limits (just) of existing process technology.

Metaforth MF16LP

Metaforth is a start-up company in Hull, founded by Dr Alan Winfield (a sometime *PCW* contributor) and Dr Rod Goodman, both late of Hull University. Alan Winfield is well known in the Forth community for writing one of the best tutorial books on the language, and for implementing Forth systems. Being an electronic engineer by training, however, he was not satisfied for long with purely software solutions, and set about designing a RISC computer to directly execute Forth code. The result, the MF16LP, is now starting manufacture at Metaforth.

Forth is at first sight an oddity among computer languages. It's both compiled and interpreted, it uses an explicit stack for arithmetic, and it compiles threaded code which consists of lists of pointers rather than machine instructions. This curious structure makes immediate sense, though, when you stop regarding Forth as a high-level language and look upon it as the extendable instruction set of a hitherto non-existent 'stack machine'. Existing Forth systems mimic this machine by implementing its instructions as subroutines written in the machine code of a host processor such as the Z80 or 68000.

Due to the overhead imposed by threaded code, and because the architectures of most microprocessors don't fit very well with its virtual machine, Forth is not as efficient as it could be. Although Forth is many times faster than other interpreted interactive language systems like Basic and Logo, it is typically five to 10 times slower than a language like C, which compiles directly into the host processor's machine code. Certain microprocessors such as the Motorola 6809 and the TI 9900 execute Forth much more efficiently than the Z80 or 6502 do, as their architectures 'fit' the Forth virtual machine slightly better.

The Metaforth machine is a direct hardware realisation of the Forth virtual machine. It's a RISC processor which uses two dedicated hardware stacks instead of registers, and whose instruction set consists of the Forth primitive words, such as DUP, SWAP and DROP, from which other words are defined. It executes Forth much better than any conventional computer does, but due to the extreme simplicity of Forth's underlying structure, it has turned out to be a quite extraordinarily fast computer architecture in absolute terms. The present version, which is still implemented in discrete logic rather than as a chip is capable of six MIPS. A VLSI implementation, combined with optimisations that Metaforth has already discovered, promises to push this up well beyond 10 MIPS.

The MF16 consists of a single-board computer (on a double Euro-card) built using Advanced Schottky TTL devices. The parameter and return stacks each consist of 2k of static RAM, which needs to have a 35-nanosecond (ns) access time as the machine's cycle time is only 50ns. Main memory doesn't need to be quite so fast, which would be an expensive proposition, but still needs to be 55-75ns if it is not to slow down the processor.

It's amusing to see the reaction of engineers on first seeing the board, as their first question is always 'Where's the processor?'. Of course there is no microprocessor on the board, which looks for all the world like a RAM card. The whole processor requires about 20,000 transistors, which would make it a very small chip. A VLSI implementation is currently under design and will, like the ARM, be fabricated in the US.

The MF16 at present uses the customary 16-bit wide stacks with a 24-bit address bus. Consequently long address calculations must be done using double numbers; the VLSI version will go to full 32-bit stacks to avoid this.

The instruction set consists of a set of Forth primitives (chosen so that both the 79 and 83 standards can be accommodated) which are micro-coded. Part of the micro-code store is writeable: in other words, it is possible to add new machine instructions, and Metaforth intends to use this facility to customise the machine for special applications such as graphics and signal processing.

Extensive analysis has identified a set of 39 instructions which is sufficient to support a full Forth-79 or 83 system, but for efficiency reasons several other non-essential instructions are included to give a set of about 50 instructions. The great majority of these instructions can be executed in one instruction cycle.

The first prototype machine treated its instructions like conventional machine codes. A Forth assembler translated programs into streams of in-line op-codes, and the threaded nature of Forth had to be realised by CALL and RETURN instructions. However, Winfield discovered an ingenious scheme to implement threading directly into the hardware, with a zero-time overhead.

In very broad terms, the machine is split into two halves, one responsible for instruction fetch and the other for execution, each having its own stack. These halves can operate in parallel, so that the next threaded instruction can be 'unravelled' and fetched while the previous one is still using the parameter stack. This is the equivalent of the ARM's pipeline, and combined with a unique dataflow ALU architecture contributes most of the speed.

The RISCy future

RISC processors have reached the point of commercial acceptance. IBM continues to work on RISC designs (it now has the 801 on a chip), and Hewlett-Packard is also deeply involved as are smaller companies.

For example, Pyramid is selling a fast Unix system which uses a custom RISC processor, and in the US, Novix Corporation has produced a Forth chip designed by Chuck Moore, with similar capabilities to that of the Metaforth machine.

The lessons of RISC are that conventional processor designs have become counter-productively complex; that processor design is a job which requires the collaboration of software as well as hardware engineers; and that high-level languages can best be supported by simpler rather than more complex designs. END

Curtain down

It's the end of another record-breaking* PCW *Show and the final round-up of all the sights and sounds from Olympia.

At last year's *PCW* Show the radio programme *Chip Shop* recorded a panel of computer industry stars fielding questions from users. Representatives from Acorn, Sinclair, Digital Research and ACT (now Apricot) took the rough with the smooth and looked forward confidently to the next year.

One year later and things didn't look quite so rosy — the *Chip Shop* had gone and it was the magazine, *MicroScope*, which played host to a similar panel. Digital Research and Apricot were still represented, but the other industry figures now came from Compaq (the most successful PC clone manufacturer) and Commodore, resurgent again (well, that's what it says). But while some profits have gone down and losses are up in the past year, interest in the show itself has certainly risen — 70,000 people made the trip to Olympia this September, 30,000 more than last year.

For the first time, visitors to the show experienced segregation, with home machines in the National Hall and business users camped out in Olympia 2. A team of badge-checkers was charged with the onerous task of keeping the under 18-year-olds out of the business hall. All in all they did a pretty good job, and there was certainly a more relaxed atmosphere in the business section. The only intrusion into the calm was the occasional rattle of a daisywheel printer, in stark contrast to the National Hall where the air was heavy with alien-zapping and soaring synthesiser riffs.

As always, the star of the business hall was Apricot, exhibiting in its new colours for the first time at the show. On public view for the first time were the Apricot F2 and F10, both of which come with Digital Research's GEM user-friendly front end. Both the new 'F' machines are based on the F1 launched last year. The F2 costs £1495 and features twin 3½in 720k floppy disk drives, while the F10 (Benchtested in September) costs £2295 and features a 10Mbyte hard disk.

Also on the Apricot stand were the high-capacity Apricot PC models and Apricot's 'Networks' (*neé* Point 32) local area network. This was demonstrated running a brand new electronic mail system as well as a networked version of the Apricot Accountant integrated accounts package.

Next to Apricot in the business hall was Philips, showing its ':YES' budget micro for the first time in public. It would have been hard to miss this stand, with the illuminated pictures of the machine and its name in letters two feet high. This machine (Benchtested in October) is based on the Intel 80186 processor and is priced as a competitor to the Apricot F1.

Unusually, it runs a version of CP/M rather than MS-DOS. However, it is compatible with MS-DOS 2.11 and should run popular 16-bit applications. On the stand the machines were running a variety of applications, again including Digital Research's GEM. Apparently the name ':YES' was arrived at after intensive research — these marketing people can be a strange lot

sometimes.

Still downstairs in Olympia 2, Research Machines Limited (RML) was showing its 80186-based Nimbus micro running Microsoft's Windows multitasking operating system-friendly front end. This package has been around for some time, but has only recently reached the stage where it can be released. RML is claiming a UK first for its Nimbus implementation of Windows, which up to now has only been seen on the IBM.

Across the great divide in the National Hall, Sanyo was braving the rampaging kiddies to show a new IBM-compatible christened the MBC 885. This machine features twin 360k PC-compatible disk drives and 256k of RAM. With its bundled software the machine will sell for under £1400. Sanyo also used the *PCW* Show to announce price cuts on its well-established budget MBC 555, which will now sell for just under £1200.

Also in the National Hall, Sharp was showing a sneak preview of its IBM-compatible luggable, due for release early next year. The major feature of this good-looking machine is its backlit LCD which makes the screen much easier to read. It also features a fast IBM-compatible processor and twin 360k PC-compatible floppy disk drives. A hard disk should be available soon after the launch.

But it was the stands of the 'Big Five' that dominated the ground floor in the National Hall. Pride of place went to Commodore, Acorn, Sinclair, Amstrad and, victorious over the sceptics, Atari — all neatly surrounding *PCW*'s own stand.

Sinclair's stand was a sleek-looking silver and black affair, co-ordinated with the computers on show. Despite strong rumours, Sinclair did not have a new machine at the show. There were plenty of QLs displayed prominently with their new £199 price tag, and plenty of Spectrums running games both new and old. The only hint of a new product was a matt black printer placed casually alongside several of the QLs. This turned out to be an anonymous product similar to a forthcoming QL printer, but 'not necessarily the one that will be brought out.'

Sinclair was also starting to push other manufacturers' products for its machines. The inadequacies of the microdrive finally received a nod of recognition from the company with the officially-approved display of a 3½in disk drive from Micro Peripherals. This can store up to 720k and sells for £296.70 for a disk interface, single drive, power supply and utilities disk. Additional drives can be daisy-chained and cost £159.85. Also on show were several other peripherals such as a 10Mbyte hard disk with a data transfer rate of 600k per second. Plenty of software was also around.

Across from Sinclair was Commodore, with a stand about twice as large,

The PCW stand: advice and facts from the magazine's staff

but not as stylish. Commodore was putting most of its efforts into its new machine, the 128 (Benchtested in July). Next door to Commodore, Amstrad's stand was pushing the PCW8256 (Benchtested in October). A video was constantly running demonstrating its features, and several systems were available inside the stand for people to try out. Interest in these was extremely high, understandably because this was the machine's first public outing. The CPC6128 was also present in quantity and generating considerable interest, especially from irate 664 owners demanding a swap or their money back.

The Commodore 64 was on the stand for playing games or making music, but otherwise it was awash with 128s.

When asked about the other new Commodore machine, the Amiga (Benchtested in August), people on the stand were remarkably unwilling to discuss it, preferring to extoll the virtues of the 128. The Amiga was only on show behind closed doors; at a press conference given by Commodore itself and in Metacomco's hospitality suite.

Acorn had an interesting development on its stand in the form of a 128k BBC Micro. The most salient feature of this £499 machine is that it has a full 64k RAM available for Basic programs. Rumours about a BBC C were being bandied about at the show. But when questioned about its future availability, an Acorn representative replied with blank looks and a flat denial of any knowledge of its existence. Strange, when other people claim to have seen and even used it.

Atari, though, had the largest representation at the show with a total of three large stands. Practically everywhere you turned on the stands there was a 520ST, most of them running independent software. Quite impressive for its first UK public debut. In a glass cage towards the centre of the stand were Atari's latest products, locked so you couldn't get too close. Pride of place went to the 260ST, in a casing

Alex Higgins plays snooker with an Amstrad CPC6128

similar to that on the 520 but a little deeper, to incorporate an integral 3½in drive. The only other external difference was the inclusion of a PAL modulator allowing connection to a domestic TV, suggesting that the 260ST will be the rumoured Atari low-end machine.

Internally the machine will have GEM and TOS in ROM, and an unspecified amount of RAM. You would assume with the name 260ST that the machine has 256k in the same way that the 520 has 512k, but Jack Tramiel, Atari's chairman and saviour, wouldn't disclose how much memory the final machine will have. Also within the glass cage was an integral medium-resolution colour monitor with a built-in disk drive, and a pre-production version of a hard disk for the ST.

Jack Tramiel also gave some clues to further products that may be seen at the Comdex show in the States in November, although if Jack's previous announcements are anything to go by you should take all this with a pinch of salt.

With all the emphasis on the 16-bit ST range it was all too easy to ignore Atari's 8-bit machines. Announced at the show were further price cuts on these, with a number of new bundled packages. The 64k 800XL can now be purchased for £70 including a joystick and one games cartridge, while the 128k 130XE has been reduced to £140 alone, £260 complete with disk drive, or £360 with disk drive, letter-quality printer, and Atariwriter word processing software.

Vying for a place in 1985's 'Big Five' was Enterprise, with an enclosed stand called the Enterprise Pavilion. On display inside were a number of Enterprise 128s, and for the first time on public display, the Enterprise disk drive controller. Rather than build its own disk drives, Enterprise has released a controller onto which you can hang any Shugart-type disk drive. In addition the EXDOS disk operating system is designed to work with different formats of disk such as IBM or Apricot, giving a very limited form of compatibility. Also on show for the first time was a new Enterprise mouse and a cheaper Enterprise monitor.

Not content with one stand, MSX was all over the place. Toshiba was running a 'name of the future' exhibition on the gallery of the National Hall, which covered all the domestic things that MSX computers could be used for, such as video, music synthesisers, digital television (running from a video recorder, unfortunately), games and even some serious computing. The home of the future looked remarkably like the home of the present, but having said that, some of the MSX products on show were impressive.

More games were also on display on the Atari stand — with one, Brataccas, really standing out as making the most of the 520ST's powerful graphics capabilities.

When you consider that Psygnosis, Brataccas's manufacturer, can boast the now defunct Imagine's (the name remains but not the company) Eugene Evans among its programmers, it's not surprising that this arcade adventure game is something special.

Over on the Activision stand, the quirky Little Computer People game was attracting a lot of attention. This strange program contains an animated character who is supposed to live inside your micro. If he is left to his own devices, the little man will wander around the screen, going about his everyday chores, whether it be feeding the dog, having a shower or playing the piano. Interaction with the character is possible, although he'll not always do what you want him to. Apparently he's often receptive to being patted on the head!

Acorn exhibited its 128k BBC Micro, but there was no BBC C

Two other memorable games from Activision were Barry McGuigan World Championship Boxing, which was in danger of becoming lost in the plethora of boxing games on show, along with LucasFilm's excellent Ballblazer.

Under the shadow of the National Hall's gallery, Melbourne House was competing with a bedraggled looking Donald Duck for custom. Both its new adventure, Terrormolinos!, and Fighting Warrior, a game utilising many of the techniques used in Way Of The Exploding Fist, look set to be two future hits.

The Lord Of The Rings, the long awaited follow-up to The Hobbit, is close on the horizon and could even be ready by the time you read this report.

US Gold had very little that was new actually on sale, but concentrated more on previewing its next big releases. These include Winter Games, The Goonies and Fight Night.

Upstairs, tucked away in a corner of the gallery, was Wizard Computer Games. If you've never heard of it, you soon will, because William Wobbler, yet another Tony Crowther game, has all the hallmarks of Monty Mole and looks like becoming just as popular.

The winners of the Visicode competition were also presented with their prizes in the gallery. Winnie Whiting, Christopher Stops, Gordon Lobley and Kevin Denyer made it to the show to receive the prizes from Micronet — the two absentees were Mr M Issott and Kevin Parr.

Other sights were Ariolasoft's massive video wall which, although disappointing, certainly drew in the crowds each time a Madonna video was shown.

Included among the attractions at the show were various competitions being run on the *PCW* stand. Macmillan Software started a competition to find the Young Computer Film Maker of the Year, where you have to create a mini-movie using the firm's Screenplay package. The closing date for entries is 30 November.

And Apple held a design competition featuring the Macintosh and MacPaint (another major Macintosh competition is being planned for the next issue, so place your orders now). Each competitor at the show was given 30 minutes to create a suitable design, and while the non-artists beavered away with the mouse, professionals brought in by Apple were showing what could be done. Bottles of champagne were handed over to the best designs produced by the amateurs, and what were they designing? — logos for next year's show. But that's it for 1985 — same place, similar time next year. See you there. END

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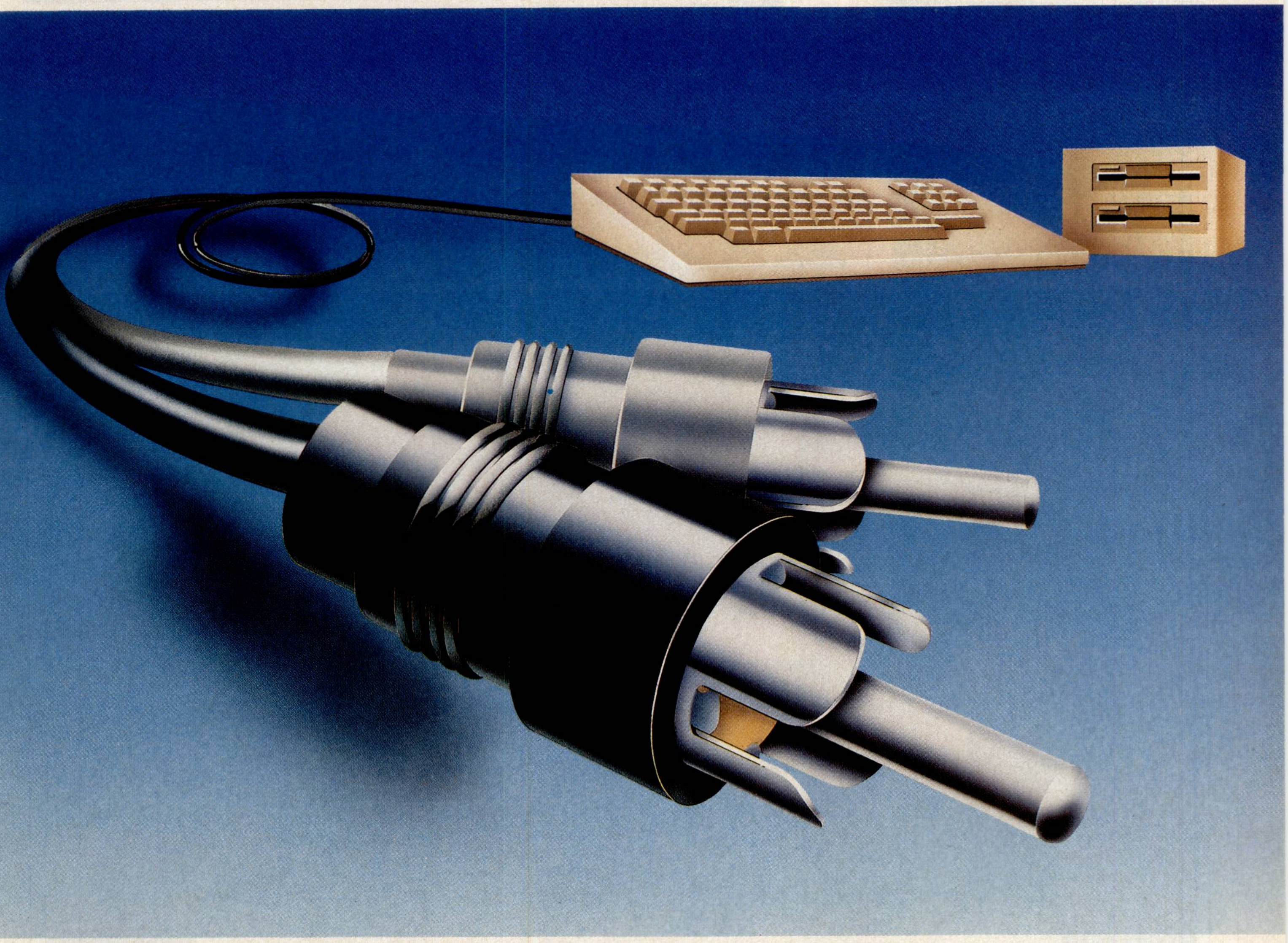

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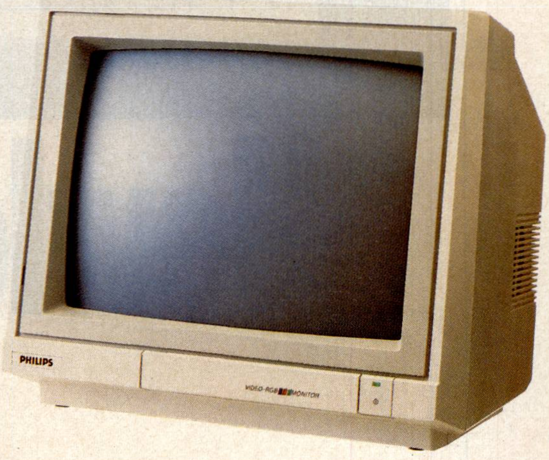

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PCW 2

PHILIPS. TAKE A LOOK AT OUR IMAGE.

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Hewlett-Packard Vectra

The Hewlett-Packard Vectra is an IBM PC/AT lookalike — which raised a glimmer of excitement in the PCW office. Peter Bright found lots he liked about the system, including an excellent keyboard and display, coupled with HP's customary style and engineering.

Whenever Hewlett-Packard launches a new micro, we usually get quite excited in the *PCW* office, because even if it isn't very interesting, we can always marvel at the way it's put together.

Hewlett-Packard has always had something of a reputation for going its own sweet way in the micro market, but recently it has decided that if it is to survive in the mass market, it needs to be able to access the pool of hardware and software generated by the likes of IBM. The first machine that showed signs of this was the HP150 touch screen which used an Intel 8088 processor and ran MS-DOS. Now Hewlett-Packard has gone a stage further and launched an Intel 80286-based IBM PC/AT compatible machine.

Hardware

The first impression I had of the Vectra was one of quality and style. The design is similar to the majority of other business micros — three cream-coloured boxes containing the display, keyboard and digital electronics, but the quality of the casings and the way they all fit together are a hallmark of Hewlett-Packard.

The main system box is significantly smaller than that of the IBM PC/AT and is less imposing when it is placed on a desk. Having said that, I still used the machine with the main system unit on the floor and the monitor and keyboard on the table.

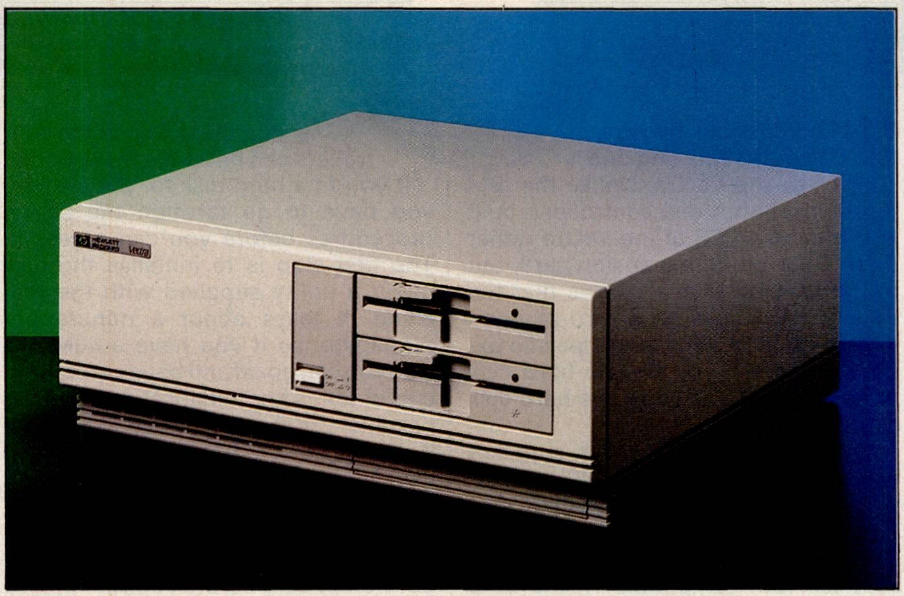
The casings are made of metal and high-quality plastics, all of which are finished in par-for-the-course cream. The front panel houses the on/off button as well as either one or two half-height floppy disk drives. Beneath these, out of view, is a half-height hard disk, although the only sign of it is an amber read/write light in the middle of the front panel. Other than these, the front panel is fairly empty apart from the Vectra badge.

Optionally you can have an IBM AT-style barrel lock fitted to the front of the system box to prevent unauthorised access to the electronics and use of the master console. The review machine excluded this lock.

The rear panel of the system box is standard PC/AT clone layout. To the left is the vent for the system fan, in the middle are power in and out sockets, and to the right are seven expansion slots. On the review machine two of these slots were in use; one for the monitor output and one combined RS232 and Centronics card.

Unfortunately Hewlett-Packard has followed IBM's route here and has not only used a 25-way D plug for the Centronics connector, but also a cut-down nine-way D socket for the RS232 cable. This can make it difficult to hook up some RS232 devices.

When the review system arrived at my home, it came in no less than nine cardboard boxes. Unusually for a consumer product, the Vectra system box is delivered to customers without disk drives, video cards, and so on, fitted. It is up to the customer to put his system together and check it out.



The main system box is smaller and less imposing that the PC/AT's

Hewlett-Packard reasons that if the product is sold through a dealer, he will assemble the system, and if it is sold direct to a large firm, the staff will be well-educated enough to do it for themselves. If the idea of assembling the machine upsets you, Hewlett-Packard offers the service at extra cost.

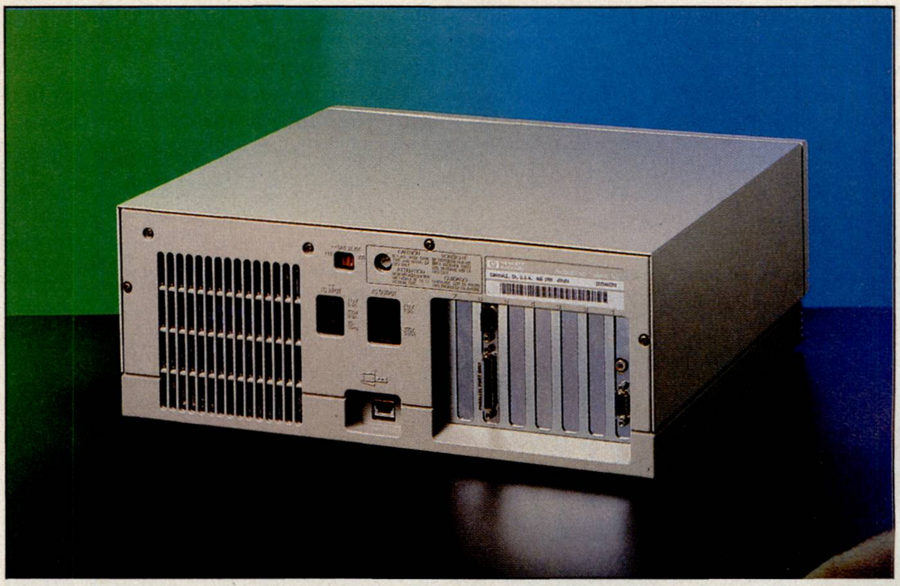
Assembling the system took about half an hour. The first stage was to unpack the main system box and take off the lid. Access is gained by removing three screws on the rear panel and sliding off the top. Unlike a number of PC clones I have seen recently, the lid on the Vectra is well engineered and slid on and off extremely easily with no catching or graunching.

As it was shipped to me, the system box contained the main PCB, the power supply, the RAM board and nothing else. The inside is dominated by a long length of plastic which forms the on/off switch and runs from the front panel to the power supply at the rear of the box.

The main PCB takes up just over half the available floor space in the system box and is very well made. It is strange how Hewlett-Packard's pre-release machines are better made than most other companies retail units.

As you would expect from an IBM PC/AT thinkalike, the main processor in the Vectra is an Intel 80286. The main difference is that the IBM PC/AT's 286 chip is clocked at 6MHz, whereas the Vectra runs at 8MHz. A quick look at the Benchmark timings will show that the Vectra is significantly faster than the IBM PC/AT. The response times and screen speed were very fast, especially when running Digital Research's GEM when windows opened faster than you could see them being formed. Unlike the Compaq Deskpro 286 I Benchtested in August, it is not possible to slow down the Vectra's processor to match the PC/AT's. A large proportion of the rest of the main PCB is occupied by expansion slots.

The Vectra has a total of eight expansion slots. Of these, five are IBM



The system box's rear panel is standard PC/AT clone layout

PC/AT compatible, two are IBM PC compatible and one is specific to the Vectra. Unlike the IBM PC/AT, the floppy disk controller is built into the main PCB of the Vectra rather than living on an expansion card, but the other side of the coin is that the system RAM lives on a card plugged into the Vectra's machine-specific expansion slot. If you have a hard disk fitted, you will need an extra hard disk controller card.

The review machine was supplied with its full complement of 640k of RAM in the form of 256 kbit chips with parity. The code in the MS-DOS ROM BIOS is supplied by Phoenix Software which supplies IBM-compatible ROMs to a large number of IBM clone makers, so IBM compatibility shouldn't be too much of a problem.

The first stage in setting up the review system was to fit the disk drives. The machine was supplied with one 5¼in 360k IBM PC compatible drive, one 1.2Mbyte PC/AT compatible drive and a 20Mbyte hard disk. The 360k and the 1.2Mbyte drives look very similar, although the 360k drive has an asterisk embossed on its front bezel to distinguish it. As with the 1.2Mbyte drive on the IBM PC/AT, you need special high-capacity floppy disks to make it work.

All three drives arrived carefully packed in foam in their own boxes. They also came with instruction leaflets warning of the dire consequences of static electricity and the dangers of dropping hard disks.

Both the floppy disk drives and the hard disk all stack above each other in the same cage. The fact that they are all half-height units means that the total height of the pile of drives is kept within the realms of sanity.

Fitting the drives into the cage is very simple. The drive units have catches built into them so that when you slide them into the cage, they are secured with a reassuring 'snap'. Everything is very well engineered and the drives slide easily into place. However, connecting the drives to the controllers can be a little more fiddly.

If you fit a hard disk for the system, you have to go through the set-up procedures before you can access it. The first step is to initialise the disk using a utility supplied with the machine. It takes about a minute per megabyte, so if you have a 40Mbyte disk you can go off and have a nice, long cup of tea. After initialisation, you can partition the disk and finally you format it. After all this has been done, you can copy files onto the beast.

After fitting the disk drives and the hard disk controller, it only remains to install the graphics card and the RS232/Centronics card before you can replace the lid on the system box and switch on.

The graphics card supplied with the review Vectra imitates the standard IBM colour graphics adaptor. It also comes with a composite monitor output which allows you to attach a monochrome monitor, in which case the colours are displayed as scales of grey. This was the set-up on the review machine.

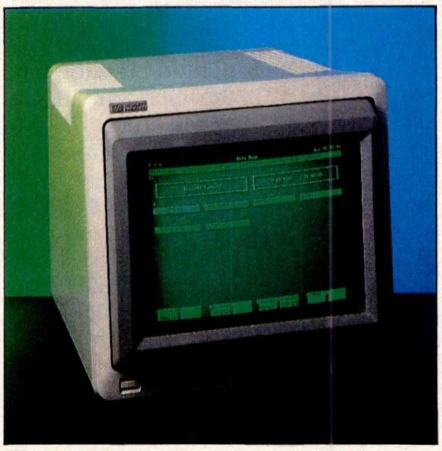
The system was supplied with a 12in monochrome green screen monitor. The first thing I noticed when I switched it on is that it doesn't whistle. Most monitors and TVs emit a high-pitched whistle which can be quite annoying. The casings are very well made, with controls for contrast and brightness on the front panel and fine adjustment controls on the rear panel.

The monitor comes complete with a swivel stand which allows you to move the screen from side to side. If you want to tilt the unit, the display tube and bezel move, but the casing doesn't.

The quality of the display was very good. The display tube has a good anti-reflective coating; the characters on the screen were well formed and everything was sharp. I couldn't help feeling that a monitor of this quality was wasted having to display low-resolution IBM-style graphics.

The review system was also supplied with Hewlett-Packard's touch screen

The 'totally wonderful' keyboard has a 'human interface loop' link



The applications program, PAM

attachment first seen in the HP150. It fits around the display tube in place of the standard bezel and plugs into a socket supplied for the purpose in the main casing. The touch screen works by projecting a grid of invisible light beams just above the surface of the display tube. When you point at an area on the screen, you break two of the light beams in the grid and the system works out what you are pointing to.

Although the system works well, the touch screen is very much an optional extra on the Vectra. The PAM applications manager works well with the touch screen, but much IBM PC software wasn't designed with the screen in mind and won't work with it.

The Vectra keyboard is totally wonderful. I have always rated Hewlett-Packard's keyboards among the best in the business, but it has surpassed itself this time.

The keyboard is massive — 20½ins wide by 9ins deep. Usually it is directly connected to the main unit via a length of coiled cable and two large telecom-style plugs to a socket on the back of the main system unit. But this is no ordinary keyboard link: it is in fact a HPHIL (Hewlett-Packard human interface loop!) link. As well as connecting the keyboard, this interface can be used to chain in the touch screen or HP mouse if you have them fitted.

Therefore, on the review system the keyboard cable was connected to the back of the monitor to the touch screen, and another cable ran from the HPHIL output on the monitor to the keyboard socket on the main system box.

With regard to the keyboard itself, there are a total of 103 keys. They are laid out in the same style as the IBM PC/AT keyboard, but with additions by Hewlett-Packard.

The main qwerty typing section follows the IBM PC/AT layout with a massive RETURN key and the removal of the / key from between the Z and SHIFT. To the left of the qwerty section are 10 programmable function keys. Eight of these are duplicated in a row above the qwerty section to make it

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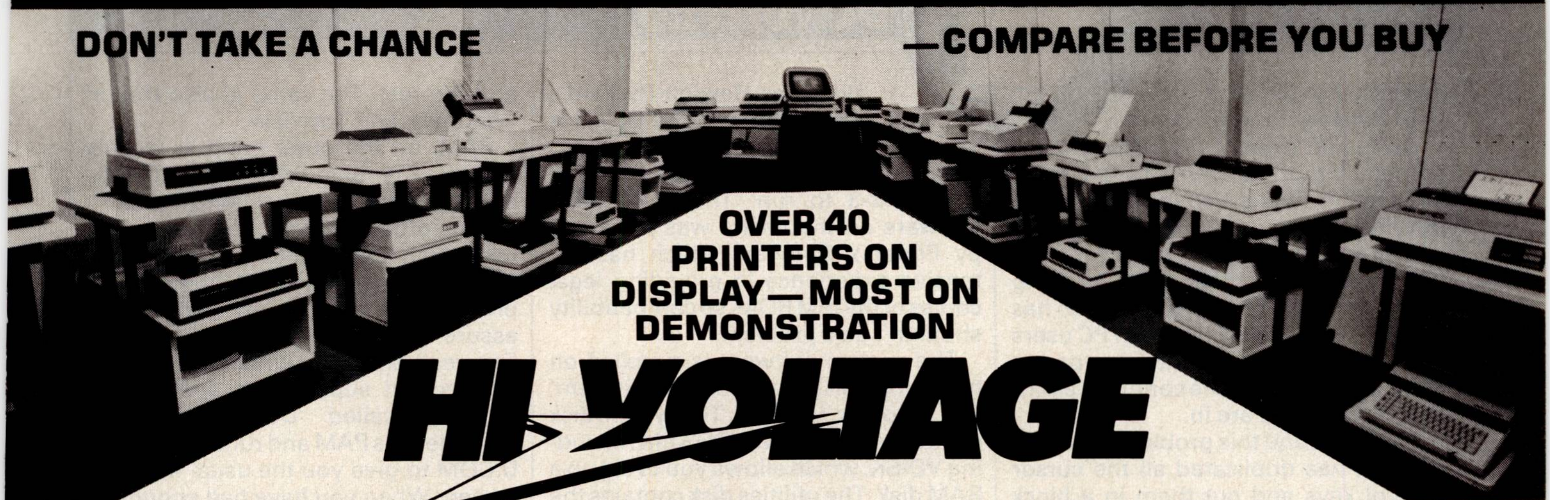

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easier to use the keys with Hewlett-Packard's PAM.

On the far right of the keyboard is a combined numeric keypad and editing key section. This is also the same as the IBM PC/AT, where you select whether you want to use the keys to enter numbers or for cursor control by using the NUM LOCK key. This approach has always been criticised by IBM PC users who avoid using the numeric keypad as it is too easy to become confused about which mode you are in.

To get around this problem, Hewlett-Packard has duplicated all the cursor control keys and put them in a block between the qwerty section and the traditional IBM-style numeric keypad. This is a great idea, and means you can have full cursor control *and* the numeric keypad both at the same time. Although this removes the need for a NUM LOCK key, Hewlett-Packard has retained it to remain compatible with the IBM PC/AT layout.

The general feel and layout of the Vectra keyboard are both very good. Like the PC/AT, the Vectra has a row of three LEDs in the top right-hand corner of the keyboard to indicate whether CAPS LOCK, NUM LOCK or SCROLL LOCK has been engaged. The layout is about the best I have ever come across on a computer keyboard, and the only criticisms are the sheer size of the unit and that the ESCAPE key still lives in its PC/AT home on top of the numeric keypad instead of being in the top left-hand corner of the qwerty section where it should be.

The feel of the keyboard is generally soft but the action is still positive. All the keys are nicely pitched, although the keytops are oddly shaped with sharp straight edges along the top of some of the keys. The key colouring conforms to Hewlett-Packard's usual practice of using red lettering for the main typing keys and green lettering for functions, accessed via the SHIFT key.

System software

As you would expect from an IBM PC/AT compatible system, the Vectra runs MS-DOS version 3.1. This is basically a rehashed version of MS-DOS, designed to make partial use of the extra facilities of the Intel 80286 chip. The idea always was that IBM would release its version of the Unix multi-user operating system which would take full advantage of the 80286 chip, but something seems to be wrong because IBM's version of Unix still isn't out and we're still stuck with an operating system that doesn't take full advantage of the system.

One of the most glaring examples of this is that the operating system can only access 640k of RAM, even though the hardware can access considerably more.

However, Hewlett-Packard's implementation of MS-DOS 3.1 is as good as any, and I had few problems getting popular PC programs such as Lotus 1-2-3 to run. The ROM BIOS software on the Vectra was produced by Phoenix Software which has extensive experience in providing legal copies of the IBM ROM, so compatibility shouldn't be a problem.

The system software is supplied on two floppy disks, one marked 'System' and the other 'Utilities'. The system disk contains the usual MS-DOS files including VDISK, which allows you to set up a RAM disk. The utilities disk contains the less frequently used MS-DOS utilities along with a number of device drivers for hardware, such as Hercules graphics cards and Hewlett-Packard's Laserjet laser printer.

When you first run the system, it is necessary to run a utility called Set-up. This alters the data in a special battery-backed area of RAM which contains system configuration information. Using the main Set-up option you can set the date, time, memory size and floppy disk characteristics, and tell the system which display adaptor you are using. You can also use Set-up to realign the touch screen if you have one, prepare the hard disk to be moved, and initialise the hard disk if you are using it for the first time.

Most Hewlett-Packard machines come with the applications program, PAM (Personal Applications Manager). I first saw this on the HP150 micro and subsequently on the HP110 portable, as well as this machine.

PAM was an early attempt to create a 'friendly front end' to sit in front of MS-DOS and shield the user from the perils of the A> prompt. Recently other companies have begun offering their own front ends. Examples of these are GEM from Digital Research, Windows from Microsoft and, to a lesser extent, TopView from IBM.

The main difference between these front end systems and PAM is that they are generally graphical in their approach. GEM does a fairly good job of making IBM clones look something akin to a Macintosh, with icons, windows and the rest. The same is also true of Windows, and TopView.

PAM, on the other hand, is mainly textual. The main PAM screen can be divided up into five functional areas. At the top of the screen there is a prompt line which usually tells you what to do next. Below this is the MS-DOS A> prompt which is mainly there to reassure dyed-in-the-wool DOS users. For real MS-DOS enthusiasts, Hewlett-Packard supplies an applications program called 'DOS Commands' which leaves PAM and runs COMMAND.COM to give you the usual MS-DOS screen. When you have had enough of this, you can type 'Exit' and be returned to PAM. Under the command line are two windows: one displays the Hewlett-Packard name; the other displays the current date and time.

The main part of the PAM display takes up about half of the total screen space below the date and time window. This area shows the names of all the currently installed applications programs on disk, and is the area where you select the program you want to run. Below this there are eight function key boxes which match the duplicated function keys on the keyboard.

In the main PAM screen, only five of these function keys are used. These are marked Start Applic, Set Date and Time, Manage Applics, Show .EXE.COM.BAT and Help.

The most commonly used function is Start Applic which, as its name suggests, starts the applications program selected from the list of applications in the main section of the PAM screen.

The method of selecting the applications program you want to use varies according to your Hewlett-Packard hardware. If you just have the keyboard, then you can use the cursor keys to move the cursor around and highlight the application you want to start. You then press function key 1 to run the program. If you have a Hewlett-Packard mouse, you can use this to move the cursor instead of the cursor keys.

If you have the touch screen attachment and you want to activate an applications program, point to the name of the program on the screen (say, Lotus 1-2-3) and then point to the words 'Start Applic' at the bottom of the screen. Then sit back and watch it go. When you have finished with the applications program and have exited to DOS, PAM automatically reloads with the message 'Press any key to continue'.

If you want to run a program which hasn't been installed into PAM, you have two options: either install it, or select it using the Show .EXE.COM.BAT function. This is useful for selecting a program which is used infrequently and, therefore, isn't worth installing into PAM.

Benchmarks

BM1	0.5
BM2	1.5
BM3	3.0
BM4	3.1
BM5	3.3
BM6	5.8
BM7	9.1
BM8	9.6
Ave	4.5

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January issue.

Selecting Show .EXE.COM.BAT displays a list of all executable files on the screen. To run a program, you touch its name and Start Program or hit function key 1.

To install an applications program into PAM, you select the Manage Applics function. This brings up a secondary display with function key labels marked Add, Delete, Modify, Recorder and Auto Start. If you select Add, PAM displays a list of applications programs it already has the necessary details for. This list includes most of the popular applications programs such as Lotus 1-2-3, Microsoft Word, dBaseIII, and so on. If your program is on the list, you select the name and press Add Applic. PAM then asks you which sub-directory the program file is stored in and adds the program to the list of installed applications.

If your program is not on the list that PAM already has details for, you press the Add Unlisted key. PAM will then ask you which sub-directory the program is stored in, what you want it to be called in the main PAM screen, and which MS-DOS command runs the program. When you have entered these details, the program is added to the list of installed applications in the normal way.

As well as having functions built in, PAM is supplied with an applications program called 'File Manager' which makes it easier for users to manipulate disk files and sub-directories. The file manager program is run from PAM just like any other application by selecting the name and then Start Applic.

When File Manager has loaded, you are presented with a partial list of the files on the current disk. You can use the PAGE UP and PAGE DOWN keys to scroll through the list of files.

Six of the function key legends at the bottom of the screen are used by File Manager. These are labelled Delete File/Dir, Make Dir, Choose Dir, Copy File, Rename File and Exit File Manager. These generally duplicate functions provided by MS-DOS but present them in a more understandable form.

For example, if you want to change to a sub-directory in MS-DOS, you would type CD/MYDIR. Using File Manager, you just point at Choose Dir which displays a highlighted list of available sub-directories. You then point at the sub-directory you want to enter, and File Manager moves you in there.

I found the PAM/File Manager combination easy to use, but less than inspiring graphically. The touch screen makes PAM even simpler to use, although I doubt if I would buy a touch screen just to run PAM.

Applications software

The review machine wasn't supplied with any applications software, so I tried some IBM software that happened to be in the office. The Vectra ran Lotus 1-2-3 without any problems and even booted a copy of PC-DOS version 2.1. It also happily ran our de-kludged version of Digital Research's GEM. In fact, I have never seen GEM run as fast.

Hewlett-Packard didn't supply Basic, so for the purposes of Benchmarking I used an Olivetti M24 version of Microsoft's GW-Basic. This ran quite happily as the Benchmark timings show.

Documentation

When the Vectra goes on sale, it will be supplied with four printed manuals entitled Book 1, Book 2, Book 3 and, not surprisingly, Book 4. Book 1 covers setting up the machine and installing the various bits necessary to make it go. Book 2 tells you how to hook peripherals such as printers and the touch screen to the system. Book 3 is a general user guide, and Book 4 is an MS-DOS reference manual.

At the time of writing, the final printed manuals weren't available, so I was supplied with giant photocopied versions of the proofs. These were generally useful and indicated that the final manuals will be very good indeed.

The main thing that amused me was that in all the manuals, I couldn't find one direct reference to IBM or the PC/AT which the Vectra is based on. It's as if Hewlett-Packard is trying to pretend that it just happened to come up with a specification that matches IBM's PC/AT.

Prices

At the time of writing, the prices for the Vectra hadn't been fixed. All Hewlett-Packard would say was that the low-end Vectra would be slightly cheaper than a comparable IBM PC/AT. The higher specification machines will probably cost about the same as a PC/AT, which means about £4500.

Conclusion

I was worried when I received the Vectra for review. It's usually very difficult to get excited about IBM PC or PC/AT clones: by their very nature there is usually little new to say about them.

But this machine is good enough to make it all worthwhile. The basic hallmark of Hewlett-Packard has always been well-made, well-engineered machines. I am glad to say that even though the company's machines have been hampered by the PC/AT design, this still holds true. Everything on the Vectra fits together very well, and neat touches abound.

A great many IBM clone makers fall into the trap of just copying the IBM design and not making their products any better than the original. I am glad that Hewlett-Packard hasn't fallen into this trap. The Vectra is better engineered than the PC/AT; it is faster, looks better, has a nicer display and a superior keyboard. If you like the idea of the touch screen, then that's a plus too, although I doubt its worth when you are running PC/AT software.

If you are looking for an IBM PC/AT clone and money is no object, I would advise you to take a close look at the Vectra. END

Technical specifications

Processor:	8MHz Intel 80286
ROM:	64k
RAM:	640k
Keyboard:	103 keys; IBM PC/AT style with Hewlett-Packard improvements
Display:	Composite monitor; IBM colour graphics, adaptor compatible
Size:	16.75ins × 15ins × 6.25 ins
I/O:	Five PC/AT compatible slots, two PC-compatible slots and one dedicated slot
DOS:	MS-DOS version 3.1, PAM user interface

In perspective

This machine represents quite a departure for Hewlett-Packard. Until now, the company has made very nice, extremely well-engineered machines which went their own way and were probably the better for it.

The rot set in with the HP150 which had an 8088 processor and ran MS-DOS, Hewlett-Packard pulled back from the brink by giving it a touch-sensitive screen and 3½in disk drives. The HP150 was a superbly well-engineered machine as Hewlett-Packard didn't have to follow anyone's example but its own.

With the Vectra, Hewlett-Packard has finally jumped into the fray with an IBM PC/AT clone, and at the same time it can be said to have compromised some of its standards. There can be no doubt that the Vectra is an extremely well-made machine. It is designed to sell both to Hewlett-Packard's traditional markets and to the wider business audience who want the software and hardware standardisation that IBM brings, but who also want the kind of quality engineering that Hewlett-Packard has always offered.

Unlike most other PC/AT clones, the Vectra has enough distinguishing features to mark it out as superior to the competition, while at the same time it retains the compatibility with the PC/AT necessary to its acceptance in the IBM market-place. The Vectra should do very well.

CHECKOUT

Olivetti M24SP

Peter Bright looks at the M24SP, Olivetti's upgraded PC clone which sports the new enhanced graphics card (EGC), offering a very fast graphics system.

Ever since IBM launched the PC/AT, I have been waiting for Olivetti to come up with an alternative. However, it looks as if we shall have to wait a little longer, as instead of launching an AT clone, Olivetti has introduced an upgraded version of the M24. The new machine is to be known as the Olivetti M24SP.

Visually, the M24SP is very similar to the M24. Both machines share the same casings although the front panel on the SP is plain grey rather than black, which makes the machine look taller than the standard M24. The monitors and keyboards offered on the SP are exactly the same as on the M24.

The method of getting inside the SP varies according to whether you want to get at the expansion boards or the main processor board. If you want to get at the main board, you remove the bottom panel; everything else is accessed by removing the top cover.

Like its sister the M24, the SP comes with RS232 and Centronics ports built into the main board. On the M24, if you want to plug in more than one extra IBM expansion card, you have to buy a bus converter board which allows you to attach both IBM and custom-designed Olivetti boards. On the SP, the bus converter is included in the price.

The main processor in the SP is similar to the 8086 used in the M24. The only difference is that its speed has been pushed up to 10MHz from the M24's 8MHz. This compares with the IBM PC which uses a cut-down version of the 8086 processor running at 4.7MHz.

The only omission in this area that I could find on the SP is that it is not possible to slow down the processor to IBM's speed. A minority of IBM software relies on the machine's 4.7MHz clock rate for correct timing, and becomes confused when the machine runs faster.

As you would expect of a top-end machine, the M24SP is supplied complete with 640k of RAM. This is the maximum that PC-DOS can access, and should be sufficient for all but the largest spreadsheets.

The SP also comes complete with a 20-Mbyte hard disk and one IBM-compatible floppy disk drive. Again this is in line with Olivetti's aim of providing AT-level performance in a PC package.

Like the M24, the SP can be supplied either with an IBM PC style keyboard or with one of Olivetti's own.

Of the two, the Olivetti design is better. The keys are well spaced with decent gaps separating the different functional groups. The Olivetti keyboard also has twice as many programmable function keys, which run along the top of the keyboard unit. Its main disadvantage is that it isn't IBM compatible, and therefore keyboard overlays and documentation designed for the IBM keyboard cannot be directly related to the Olivetti keyboard. However, Olivetti does supply its own function-key overlay on which you can scribble your own legends.

The IBM-style keyboard has an identical layout to that of the IBM PC. The only difference worth noting is that the NUM LOCK and CAPS LOCK keys have on/off LEDs built-in. Since the M24 was launched I've used its IBM-style keyboard extensively, but the more I've used it the less I've liked it. The main problem has been that the contacts on the keys tend to get dirty, and after a while they stop registering the keypresses. You then have to take off the key and clean the contacts. While this is quite easy to do, it's still annoying.

Display

In keeping with its M24 roots, the SP is supplied with Olivetti's standard colour graphics adaptor.

The standard Olivetti graphics card works in two modes — IBM-compatible and native mode. In IBM mode the screen displays standard 640 × 200 pixel IBM graphics. In native mode, the resolution goes up to 640 × 400 pixels.

As well as the standard graphics card, Olivetti has recently launched an enhanced graphics card offering up to 16 colours in 640 × 400 pixel resolution. This will work on either the M24 or the M24SP, and I was interested to see how it performed in the SP.

One of the advantages of Olivetti's enhanced grahics card is that it works with Olivetti's standard monitors. This is not true of IBM's enhanced graphics card, which needs a new monitor as well as a new card. The main problem with Olivetti's card is that it isn't compatible with the IBM card. Olivetti, however, says that only specialised users will want the card, so they can write machine-specific software to take advantage of its features.

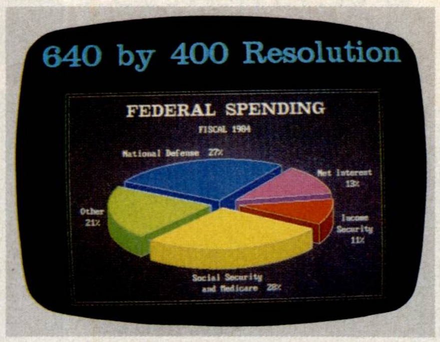
The enhanced graphics card (EGC) installation kit consists of a full-length expansion card, an MS-DOS driver, an enhanced version of GW-Basic and a new set of BIOS ROMs. The card will only work with ROM versions 1.21 or later, so new ROMs are included in the kit in case an upgrade is necessary. The MS-DOS driver is a filter to ROM-BIOS interrupt 10 which drives the card.

Fitting the EGC card into the M24SP is very easy: you simply plug it into a spare slot in the bus expander card next to the standard colour graphics card, and attach a ribbon cable between the standard graphics card and the EGC. If you have a standard M24 without the bus expander, the card has been designed so that you can attach it to the standard colour card without having to go out and buy a bus expander.

The enhanced graphics card is based around an NEC 6845 video controller chip. The card piggybacks onto the standard graphics card, and adds three more graphics planes to the one already on the standard card to give a total of four independent graphics planes. Each plane has its own 32k chunk of RAM on the card, with the result that the full enhanced graphics system has a total of 128k of RAM totally independent of the main system RAM. The combination of having its own graphics processor and its own RAM means that graphic displays can be produced on the enhanced graphics card with virtually no demand on the main 8086 processor. This creates a very fast graphics system.

Inherent in the design of the enhanced graphics card is the use of a look-up table (LUT) to determine the colours displayed onscreen. The video hardware supports 'dithering', which allows you to mix the basic 16 colours to produce a palette of 16,576 different

GEMPaint's house in 640×400 pixels



Business graphics on the EGC card

colour shades. Using the LUT, it is possible to change the colour of the image onscreen very quickly without having to re-draw the image.

As the enhanced graphics card has four independent graphics planes, the programmer is allowed a large degree of flexibility of graphics resolution.

In transparent mode, most of the board sits around twiddling its thumbs and you have standard IBM PC 640 × 200 pixel colour graphics. In graphic mode, you use all four planes to display 16 colours out of a palette of 16,576 colours in full 640 × 400 pixel resolution. In overlay mode, you can mix text and the graphics bit-map by using one or two of the graphics planes for 80-column by 25-line text and the others for high-resolution graphics. By using three different modes, it is possible to produce a very impressive variety of effects.

GEM

The review M24SP was also running a pre-release version of Digital Research's GEM friendly user interface. For those of you who haven't come across GEM before, it sits on top of PC-DOS and provides a user-friendly graphical interface which looks very similar to the Apple Macintosh.

The great advantage of GEM from a programmer's point of view is that it will run on a wide range of machines, and it is easily adapted to suit the capabilities of the hardware.

The major problem with GEM is that if you want it to run in high-resolution colour, you need a lot of computing power to make it work at an acceptable speed. For example, the Apricot F1 runs a colour version of GEM, but its processor isn't quite up to having to cope with computing the graphics shapes and updating the colour screen. The result is that GEM on the Apricot F1 can sometimes be slow.

Due to colour GEM needing a fair amount of processing power, I was very interested to see how it ran on the SP. In theory, the SP is an ideal GEM machine. It has a hard disk for fast disk access, a very fast processor for computing the shapes, and a dedicated graphics controller to make sure that the screen display is fast.

To take advantage of the extra capabilities of the enhanced graphics card, Digital Research has written a special GEM screen driver to allow GEM to use the full 16-colour 640 × 400 pixel resolution allowed by the card. If you don't have the card, technically there is no reason why you shouldn't run the IBM version of GEM on the M24. However, Digital Research has played a dastardly trick, and patched the GEM program so that it will only work on an IBM and not on any other compatible machine.

The reason for this is that the company can then obtain licencing money for GEM from each individual PC-clone manufacturer, rather than just from IBM. This is all very well, but it does mean that if you use an IBM in the office and an Olivetti at home, you need to buy two different copies of GEM to run on what are basically two compatible machines.

If you are a programmer, you can get around the patch merely by changing one machine code command in the GEM program. This is what we have done in the *PCW* office, but our lawyers advise us against making the patch public.

Even if having machine-specific versions of GEM can be a problem when buying the product, it does at least have the advantage that the Olivetti version of GEM uses the full resolution of the machine. It also allows you to use the Olivetti mouse, which is plugged into a D socket on the back of the keyboard. I found the Olivetti mouse easy enough to use but it was under-geared, which meant that I had to move the mouse a long way to get the cursor from one side of the screen to the other.

In use, I found GEM on the SP with the enhanced graphics card to be generally very good, although not quite up to my expectations. GEM is certainly fast but it still doesn't seem as fast as the version on the Atari 520ST. I was disappointed that the colour capabilities of the machine weren't put to better use in the GEM Desk-top program. Out of all the colours available only two are used for the Desk-top, and while the others are available in GEMDraw and GEMPaint, the overall effect could have been more colourful.

Having said that, you can certainly get some very impressive effects using all 16 colours in GEMDraw and GEMPaint. The review machine came with a very impressive GEMPaint picture of a cottage using all 16 colours.

In addition to using GEM to access the high-res card, Olivetti also supplies an enhanced version of GW-Basic so that you can make use of the card from Basic. The enhancements take the form of four new or altered GW-Basic commands. These are COLOR, SCREEN, PALLETTE and PALLETTE USING. Using these commands, you can control the extra graphics modes and all the additional colours allowed by the enhanced graphics card.

Prices

The EGC card costs £517 with the software costing an extra £65. The M24SP, complete with 640k of RAM, a 20Mbyte hard disk and an IBM-compatible floppy drive, costs approximately £4000.

Conclusion

The Olivetti M24 has always been one of my favourite IBM clones, so I had high hopes for the M24SP.

The average Benchmark timing was 5.9 seconds, which shows that the M24SP is certainly fast. In fact, it is significantly faster than the IBM PC/AT even though it doesn't use the AT's 80286 processor.

I think that the main reason that people are buying IBM PC/ATs at the moment must be that they want to run IBM PC programs faster. At the time of writing IBM still hasn't come out with Xenix for the AT, and I have yet to see an applications program designed expressly for the AT, so these users aren't using the AT to its best advantage.

Given that ATs are being purchased by speed freaks, it makes sense to use a fast IBM PC style machine such as the M24SP rather than the not-particularly-PC-compatible IBM PC/AT. However, this can only be a short or medium term advantage because when dedicated IBM AT software starts to appear, the M24SP's advantage will be lost.

To a lesser extent, the same argument applies to Olivetti's enhanced graphics adaptor. It certainly is very impressive, but its main problem is that it isn't compatible with IBM's EGA card/monitor combination. This isn't a problem at the moment as very few people are prepared to buy IBM's card and monitor, and very few software companies yet support the EGA display.

However, this situation is likely to change as more software companies standardise on the EGA card. Nonetheless, Olivetti's strategy of encouraging specialist software suppliers to write specifically for the card should help its prospects. Also, the fact that Digital Research has written a GEM driver means that most GEM software should run on the card.

Overall, if you are looking for an IBM PC style machine to do heavy computational work and were previously thinking of buying an IBM PC/AT, this could be the machine for you. END

Kaypro 2000 vs Toshiba T1100

Nick Walker looks at two of the latest IBM-compatible lap-helds. In an already overcrowded market, will the Kaypro 2000 and Toshiba T1100 be able to make their mark?

Photographs by Crispin Thomas

Two areas of the microcomputer business that show no sign of slowing up in terms of products from manufacturers are that of IBM-compatible and of lap-held machines. While I have no doubt that users are still moving to IBM in big numbers, I have yet to see figures that show significant sales of either compatibles or lap-helds. The machines Benchtested here, the Toshiba T1100 and the Kaypro 2000 are both IBM-compatible and at the leading edge of lap-held technology with full-size screens and built-in disk drives.

The Kaypro's ten function keys form a single row above the keyboard

Unfortunately the ALT and CAPS lock keys are still level with the space bar

Kaypro 2000

Hardware

I like the Kaypro 2000. Before I even opened it up I liked it — with its sleek dark grey matt exterior it really has definite appeal.

The machine is about A4-and-a-half in physical size and due to the tapering on all four sides looks much slimmer than it really is. A band of black-ribbed rubber runs round all four sides, and if you look very hard you may find that a section of this pulls away at the top to form a carrying handle. Unlike other lap-helds the Kaypro is encased in pressed aluminium, not plastic. Combine this with the total lack of anything on the exterior to suggest it's a computer, and you can see why it looks so good. Full marks to Kaypro for design.

At 15lb the Kaypro is noticeably heavier than the competition, due to the use of metal for the case. To carry it around Kaypro provides an equally smart shoulder-strap carrying case.

To start the machine you press two catches on the sides and hinge the lid back in the usual manner revealing the keyboard and an LCD set in the lid. The physical act of folding the lid back switches the machine on and sets it off checking memory and prompting for a system disk. The lid hinge is further back than on most lap-tops, giving quite an expanse of metal between the keyboard and the screen. In fact this consists of a fold-up cover for the keyboard cable and what can only be described as a 'pop-up' disk drive. The keyboard has 78 full-stroke keys with alphanumeric keys in white and control keys in grey. There are some differences between this keyboard and that found on the IBM PC which are necessary to make it fit in the space available. In particular the ten function keys are placed in a single row above the keyboard and the separate numeric keypad has become an integral part of the keyboard. If I were just reviewing the Kaypro 2000 I'd have no hesitation in saying the keyboard is good, but comparing it to the Toshiba it's not as smooth a transition from IBM to lap-held. The Kaypro keyboard is good — it's just not *as* good.

The screen in the Kaypro seems small in proportion to the total size of the lid, but it is in fact a full 80 characters x 25 lines. The characters seem a little squat when compared with other LCD screens, and the presence of a large glass surround makes me suspect that a larger screen may be made available when the technology is cheaper. The graphic screen is 640 x 200 making it compatible with any graphic IBM software. My main criticism of this display is the lack of adjustment to the viewing angle. Although Kaypro claims that two viewing angles are possible I found them so similar that it made no difference. A contrast control is operated by pressing ALT and F1 to decrease the contrast, and ALT and F2 to increase it. Despite this I still found myself with the keyboard pointing vertically upwards at times in order to read the screen.

The main processor in the Kaypro is an 80C88, the CMOS version of the popular Intel 8088 processor used on the IBM PC. On the basic machine there is 256k of RAM made up of 64k CMOS chips which can be expanded to 512k internally. Along with the Toshiba and other lap-helds, the RAM is not battery-backed so that when you switch the machine off you lose anything that's not saved. Admittedly with a disk drive it's less of a problem, but on a rough estimate one access to the disk drive would take as much power as maintaining the RAM for 24 hours.

The basic unit comes with one built-in 3½in disk drive giving a total formatted capacity of 720k. As mentioned earlier, this is a peculiar pop-up affair. Push a catch at the top and the right-hand edge pops up awaiting a disk; you then insert a disk and push the whole lot back down onto the disk drive mechanism. Despite this slightly Heath Robinson approach, the drive works fine if somewhat noisily. One criticism is that there is no drive-on light, so you've no visual indication of when the drive's in use.

The manual states that the rechargeable batteries should last for around four hours with average disk access. Obviously, the more you use the disk the shorter the battery life. In practice I found they lasted around six hours, and that was with quite intensive disk access. The machine doesn't lock up when the batteries run down, but gives you adequate time to close down the operations properly.

If you hunt very carefully around the exterior of the machine you will actually find some external ports. Along the

right-hand side a bit of the rubber band folds back and behind that is a serial printer port. On the base of the machine is a 100-way connection for peripherals and two BT-style telephone jacks. An optional internal modem will be available at some time in the future, but at the time of writing it had not been submitted for BT type approval. The only other peripheral Kaypro will talk about is a 5¼in disk drive allowing the use of standard IBM format disks. It should be available by the time you read this, although the price has yet to be decided.

System software

The Kaypro 2000 runs MS-DOS 2.11, as you would expect, to make it PC-compatible. Despite a careful search through the disk I couldn't find any additional utilities not shipped with the IBM PC. One area of the system that may cause problems is printing, as the Kaypro has only one RS232 serial port. Any application that looks for a parallel port, in theory, won't be able to find it. Kaypro informs me that the ROM has been suitably patched to satisfy any application that thinks it has a parallel printer, by re-directing the output to the serial port. With all the applications I tried this worked fine.

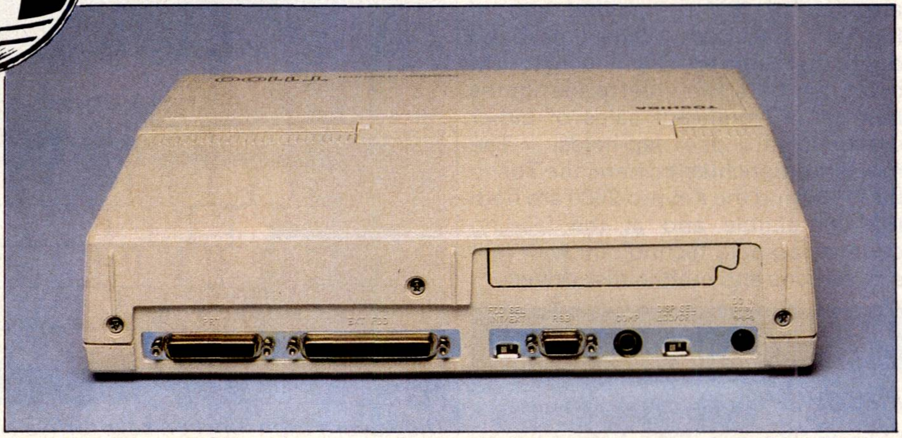
Applications software

Because the Kaypro is software compatible with the IBM PC, there shouldn't be any shortage of applications to run on it. I was unable to test the level of compatibility, although Kaypro claims that the likes of Lotus 1-2-3 and Multiplan will run.

Like the Toshiba, the major problem is going to be working out how to get the software onto 3½in disks. I couldn't glean any information from Kaypro as to specific plans to transfer software, so it may be necessary to find an organisation that specialises in transferring to different disk formats before you can run your favourite application.

Kaypro offers an optional 5¼in drive which reads IBM disks, so programs can be copied across to the internal drive. The only problem here is going to be copy-protected disks which will have to be done professionally.

In complete contrast to the Toshiba, Kaypro has bundled a wealth of applications with the machine. All the applications are well known proprietary products, so I will do no more than list them here. With the Kaypro 2000 you get the WordStar 3.2 word processor, Mailmerge for WordStar, InfoStar database, CalcStar spreadsheet, GW-Basic Mycroft Labs Mite communication package, and a package called the Travelling Expense Manager to calculate your expenses. All the applications have complete documentation, making the manuals heavier than the machine.



Switch between LCD and external displays and internal and external drives!

Documentation

There is plenty of documentation with the Kaypro, most of it referring to the bundled applications. It took me a while but I eventually found the 32-page manual necessary to guide you through setting up the machine.

All the application manuals and the MS-DOS manuals are exact copies of the originals repackaged with the Kaypro label.

Prices

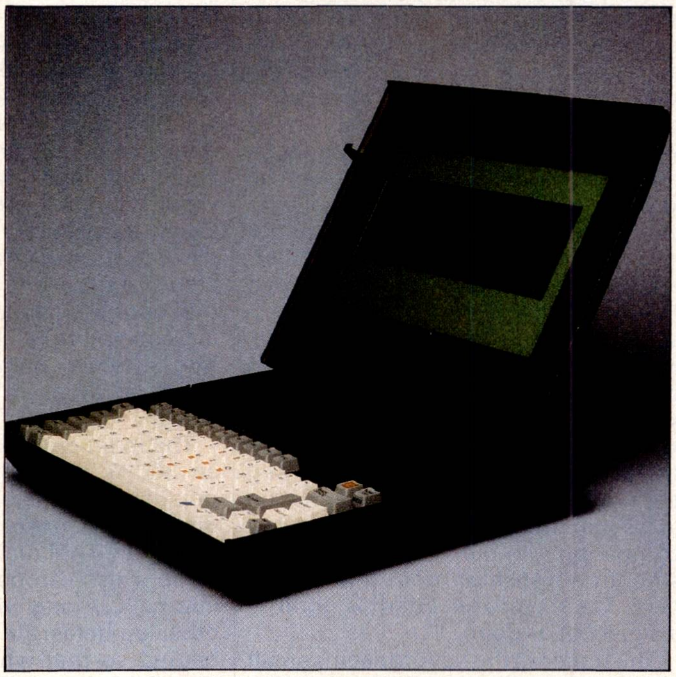
The Kaypro 2000 costs £1711 including all the bundled software, power supply and carrying case. No prices were available at the time of writing for the external disk drive and internal modem.

Toshiba T1100

Hardware

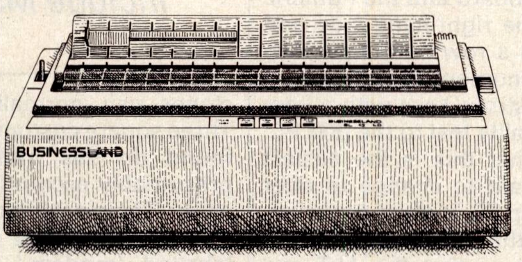
There's no doubt that the technology of lap-helds has progressed in leaps and bounds over the last few years and the Toshiba T1100 is a good example of the

A powerful hinge allows the machine to be easily tilted



Two viewing angles are theoretically possible . . .

IT LEAVES YOU WITH A GOOD IMPRESSION.



Businessland's proprietary design printer features a controlled strike energy and high quality character profile geometry.

Translated into English, that means it prints a better-looking text.

But that's only one way Businessland's own BL45LQ daisy wheel printer leaves a good impression. It outperforms the "industry standard" printers in many other ways, too.

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Because the BL45LQ printer that does considerably more, costs considerably less.

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quality of hardware currently being produced. The machine has a very solid feel and the attention to detail is of a quality comparable with the best desk-top machines.

The machine is encased in hard plastic, in the traditional IBM shade of grey. As would be expected of a machine with a built-in disk drive, it is slightly larger and heavier than the popular A4-sized machines, although still of a size that would fit comfortably in a briefcase. Provided, that is, you didn't want to carry too much besides.

'. . . the Toshiba's well-built, high-quality finish compares with the Kaypro's designer looks . . .'

Incidentally, there's no handle on the machine and Toshiba doesn't manufacture a carrying case, so it's obviously meant to fit inside your briefcase.

On the right-hand side there is a power switch and contrast wheel. I liked the inclusion of a power switch rather than a lid-activated mechanism, although it does mean you have to remember to turn the machine off to conserve batteries. The back of the machine has a connection for the mains power supply, RGB and composite monitor outputs, and sockets for an external floppy disk drive and a standard Centronics type printer. Two switches can also be found at the back to switch between LCD and external displays, and internal and external disk drives as primary drives. Toshiba makes two external drives for the 1100; a second 3½in drive and a 5¼in drive giving compatibility with applications and data using standard IBM floppy disks. The right-hand side houses the internal floppy disk drive to the rear, a 3½in Sony mechanism with a red in-use light and a large eject button, giving a formatted capacity of 360k for a double-sided disk. An optional 720k drive can be fitted internally.

Two red catches on either side are pulled forwards to gain access to the keyboard. As with most lap-helds the screen forms a lid that hinges back to reveal the keyboard. The screen is a full-sized 80 character by 25 line LCD corresponding to 640 by 400 pixels when used for graphics, making it compatible with IBM's monochrome monitor. A faint horizontal line can just be seen half way down the screen suggesting that the display is actually made up of two separate LCDs. All vertical lines that make up a character are two pixels wide giving them a slightly bulbous look similar to the IBM PC and making them much more readable than conventional characters on an LCD. The hinge on the screen is particularly ingenious as it will hold at any position from vertically upright to folded horizontally back against the rear of the machine, although after a closer examination of the hinge I wonder how long it will last. The adjustable angle of the screen combined with a better-than-average contrast control make the Toshiba display better than most at coping with different light conditions, although it is still an LCD display and as such considerably worse than a conventional monitor.

The keyboard, like the casing, takes its colour scheme directly from the IBM PC. In effect Toshiba has taken the ten function keys from the left-hand side of the IBM PC keyboard and the numeric keypad from the right-hand side and placed them in a row two keys deep above the alphanumeric keys. There is a total of 83 full-stroke keys with a very similar high quality feel to the IBM PC. The effect is that this is the easiest lap-held keyboard to change to after using a desk-top PC. It does, however, still suffer from the criticisms levelled at the PC original, in that the ALT and CAPS lock keys are still level with the space bar and prone to being hit accidentally. Two LEDs are placed in the upper right-hand corner of the keyboard, the upper one indicating low battery and the lower repeating the LED of the floppy disk drive — very reassuring when the machine is doing a lot of disk accesses.

Considering all the delicate CMOS circuitry inside, the Toshiba is relatively easy to get at. Removing a total of six screws (three at the front, three at the back) gets you inside the case. The base of the machine contains the motherboard to the front and rechargeable batteries and disk drive to the rear. The motherboard continues the high-quality impression of the exterior, with no bridging wires and all the important chips labelled on the PCB. The chip count is one of the lowest I've seen for a PC compatible, especially when the machine has effectively got a colour graphics board and 256k RAM built-in. The processor is an 80C88 running at 4.77 MHz, and while I don't doubt this makes the machine compatible I do think it's about time that someone implemented the CMOS version of the 8086 in a lap-held. Internal RAM can be expanded to 512k, which due to some quirk in the machine's architecture is also the physical addressing limit. PC clones can normally address 640k. Three square custom chips can also be found on this motherboard, which presumably accounts for the low chip count. The most interesting find on this PCB was a socket towards the rear labelled 'modem.' A phone-call to Toshiba confirmed that an internal modem is in the pipeline. In fact it's a finished product stuck in the long queue for modem approval from British Telecom.

Benchmarks

	Kaypro 2000	Toshiba T1100
BM1	1.6	1.5
BM2	4.9	5.2
BM3	9.8	10.9
BM4	9.9	10.8
BM5	11.0	12.8
BM6	20.3	21.8
BM7	31.3	33.7
BM8	31.9	34.9
BM Ave.	15.0	16.4

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January issue.

'. . . while the Kaypro's wealth of bundled software contrasts with Toshiba's failure to include MS-DOS.'

It always strikes me as odd that after putting all that effort into producing a neat lap-held machine, the power supply is about the size and weight of a housebrick. With approximately five hours of use available from a fully-charged battery, you may well want to take the charger with you to plug in at your destination. It's not a criticism just levelled at Toshiba; most lap-held manufacturers do the same. How about a smaller power supply, preferably built into the plug?

System software

After removing the T1100 from its box and switching it on you'll be prompted to insert a system disk. However, Toshiba supplies no software with the machine at all, not even system software. Fork out an extra £50 and you get MS-DOS 2.11 on disk and a couple of accompanying manuals, which is what was used on the review machine.

When the system boots up you are prompted for the date and time in the normal way (personally I prefer to see an internal clock with all that CMOS RAM available). The implementation of DOS is absolutely standard, as you would expect on a machine which is trying hard to behave like an IBM PC. Given the level of compatibility I would also expect it to run CP/M-86, although I

couldn't get anybody to confirm or deny this.

Applications software

No bundled software is included with the T1100, although Toshiba sent me a WordStar disk which worked fine. I can't personally comment on the level of compatibility, as no 5¼in drive was available. Toshiba informs me that it runs all the packages that any self-respecting clone is expected to, including the inevitable Lotus 1-2-3 and Microsoft's Flight Simulator. I tried all the applications that were bundled with the Kaypro 2000 and they all ran without fail. All the evidence points to this machine being as compatible as the best of clones.

IBM compatibility, of course, opens up the widest range of software available for a microcomputer system, although your major problem will be how to transfer these applications to a 3½in floppy. If the application is not copy-protected then buying the 5¼in drive will solve your problem. However, most popular applications are now copy-protected or work on a key disk scheme requiring a brief look at the original master disk. Toshiba is in the process of persuading some of the top software houses to transfer their applications to 3½in disk, and with the increasing number of IBM compatibles running off 3½in disks I expect to see quite a number of applications becoming available on this format.

Technical specifications: Kaypro 2000

Processor:	80C88
ROM:	24k
RAM:	256k expandable to 512k
Mass Storage:	One 3½in, 720k internal drive, optional 5¼in external drive
Keyboard:	78 keys, full travel
Size:	3.5ins x 12.4ins x 11.5ins
Weight:	14.9lb
I/O:	One RS232C serial, one 100-way peripheral bus, two BT sockets for optional internal modem
DOS:	MS-DOS 2.11
Bundled Software:	WordStar with Mailmerge, InfoStar, CalcStar, GW-Basic, Mite, and Travelling Expense Manager
Peripherals:	IBM-compatible 5¼in drive, internal modem
Power:	Rechargeable 6V-battery giving about six hours continuous use

Technical specifications: Toshiba T1100

Processor:	80C88
ROM:	24k
RAM:	256k expandable to 512k
Mass Storage:	Internal 3½in 360k disk, optional internal 720k disk. Optional 5¼in and 3½in external drives
Keyboard:	85 keys, full travel
Size:	2.8ins x 11.7ins x 12.5ins
Weight:	8.9lb
I/O	Centronics printer port, external disk drive port, RGB and composite video outputs
DOS:	None supplied, MS-DOS 2.11 available
Bundled Software:	None
Peripherals:	IBM-compatible 5¼in drive, external 3½in drive, internal modem awaiting BT approval
Power:	18-V rechargeable battery giving about five hours continuous use of 240-V AC

In perspective

The two main competitors for this machine are the Data General One and the Hewlett Packard 110. In terms of pricing Toshiba and Kaypro are better value, although neither machine can compete with the Hewlett Packard in terms of quality of engineering. (However, the 110 doesn't have a built-in disk drive and isn't IBM-compatible.) The Data General One looks very expensive in comparison, although it does have the advantage of being able to support two disk drives internally.

The Toshiba is being marketed as a go-anywhere, full-function portable which can also double as the basis of a desk-top system. With the ability to connect to an RGB monitor it may well find a little niche in the market in this respect.

The Kaypro 2000 looks better than any lap-held I've seen before, its only competitor on design being the Grid Compass which is almost twice the price. To my mind the Grid doesn't perform that much better, although it does have an electro-luminescent screen which is many times better than the best LCD.

To run the Benchmarks I used the GW-Basic supplied with the Kaypro 2000. The results are nothing to shout about, but even so are still faster than the IBM PC — which isn't bad for a CMOS machine using the same processor at the same clock speed.

Documentation

You want documentation? It'll cost you £50 and comes when you buy the MS-DOS disk. Absolutely nothing comes with the basic machine, not even a pamphlet to tell you how to open it up and switch it on.

Prices

It seems Toshiba has been taking pricing lessons from IBM. Granted, the basic machine is less than £2000, at £1950, but that doesn't include the AC Adapter at £40, so you can't charge the thing up, or the MS-DOS disk and manual at £50, so even if you did manage to charge it up you wouldn't be able to use it.

The machine will be available on the shelves of your local computer store by the time you read this, and will also have a number of peripherals available: external 3½in disk drive £495; external 5¼in disk drive £566; monochrome monitor £186; colour monitor £494; 256k memory expansion £337; and RS232C package £94. No price is currently available for the internal modem.

Conclusion

Although the market probably can't support two more PC-compatible machines of any size, that doesn't mean that these two lap-helds will fail. The advantage of having so many machines available is that you can shop around and find the one that most suits your needs and pocket.

The Toshiba and Kaypro are very competent machines offering a high degree of PC-compatibility, built-in disk drives and a full-size screen in a lap-held sized box. The inclusion of an RGB output and, effectively, a colour card in the Toshiba means that, in conjunction with a monitor in the office, the machine could be used by itself as your one-and-only PC system. The Kaypro would be better suited to being a portable addition to a desk-top PC.

Each machine has qualities that may tip the scales in its favour depending on your selection criteria. For example, the Toshiba's well-built, high-quality finish compares with the Kaypro's designer looks, while the Kaypro's wealth of bundled software contrasts with Toshiba's failure to include even MS-DOS with the basic machine. As long as you accept the limitations of a single 3½in disk drive and an LCD display, both machines are excellent lap-held packages. My leaning goes slightly towards the Toshiba but it's very marginal. END

~CHECKOUT~

Pluto II

Pluto II is an attempt to provide artist/programmers with a competent graphics system. Stephen Applebaum draws his conclusions with the aid of a BBC Micro.

Back in 1982, in what now seems the Dark Ages of popular computing, IO Research launched a revolutionary graphics system called Pluto. Not only was it interesting due to the superb graphics facilities it offered, but it also pointed the way to the future in the sense that its designers had realised the potential of putting a second processor onto a PCB separate from the host computer, with the sole aim of enhancing the latter's graphics capabilities. Three years on, Pluto is still one of the most viable propositions for the artist/programmer, and has grown in stature thanks to a major enhancement in the form of Pluto II.

More interestingly for BBC users, Peter Block and his cohorts at PLB have built an interface to link Pluto to the BBC Micro, and have transformed all the complex Pluto commands into a set of procedures which can be called from within BBC Basic.

This provides graphic designers with a comparatively cheap alternative to systems costing tens of thousands of pounds.

I use the word 'cheap' reservedly: at £4175 for a complete Pluto system, plus the cost of a second monitor, creating graphics on the BBC Micro with IO Research's baby is still a costly business, confining it to the more opulent end of the micro market.

On its own Pluto II costs £2500; the rather staggering sum of £4175 is reached when you add on such things as a five-card box in which to sit Pluto (£425), the frame-grabber (£300), and an additional 512k of onboard memory.

If you purchase all these through PLB, the BBC software and interface are free. Existing Pluto owners who want to link the board to the BBC will have to pay for it. The price break-down is as follows: LIB 1.0 Pluto library with interface box and cable for Pluto (£90); LIB 1.1 Pluto library and digitiser software with interface box and cables for Pluto (£100); LIB 1.2 Pluto library, screen-saving routines and digitiser software with interface box and cables for Pluto (£120); SGP 1.0 Simple Graphics Package with full Pluto library (first release) (£250). Three further versions of SGP are planned, and will be available to present users at no extra cost.

Hardware

As a piece of hardware, Pluto is not very exciting to look at. It is an 8in square PCB housing a 16-bit 8088 processor, 512k of memory (expandable to 1Mbyte), hardware PAN and ZOOM commands held in ROM, a palette of 256 colours from a choice of 16.7 million, and an RS232 interface. The exceptionally large number of colours comes from additional screen memory provided by the palette and the way in which Pluto handles its display.

With the palette, Pluto is able to produce eight planes of display memory which in turn creates an eight-bits-per-pixel frame buffer; the result being that any pixel onscreen can be individually set to any one of 256 colours.

The onscreen appearance of the colours is handled by the palette. This comprises a look-up table which maps each of the pixel values (0 to 255) to a colour on the screen, and three high-speed digital-to-analogue converters which provide variable intensity drives to the colour monitor RGB inputs.

Each colour is defined in terms of its red, green and blue primary components. As each component can be one of 256 colours, the total number of available colour combinations is 256 × 256 × 256, making over 16 million.

Although Pluto provides graphic designers with all the facilities they could want, most will probably find it too much to handle unless they have a decent knowledge of programming. Even the Pluto and Pluto II manuals are so steeped in jargon, concentrating more on the hardware architechure than how to use it, that non-programmers could find themselves severely handicapped by major gaps in their understanding, not necessarily because they understand nothing of how the system works, but because they've never had to do any programming before.

PLB's software and hardware, on the other hand, is aimed not only at the computer-literate user, but also those with a less extensive knowledge of the subject. For instance combined with the Basic procedures there is a drawing program that puts the package within the reach of even the most non computer-wise user. However, if you want to do anything more complex than purely drawing, you will have to know something about programming.

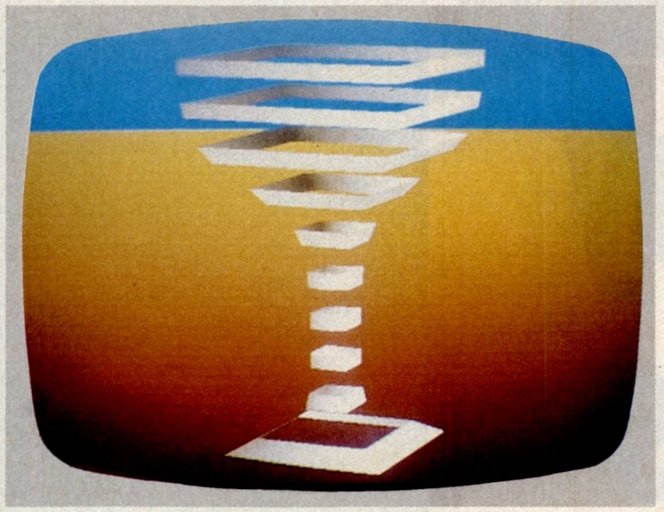
PLB's contribution to the Pluto system comes in two parts: an interface to connect the board to the BBC; and a software suite to make it more accessible to the general user. The interface is a simple little box with three ribbon cables originating from it. Two of them go to the BBC's user and printer ports, while the third runs off to the Pluto board.

Surprisingly, two separate monitors are required for the computer and graphics board. The monitor taking output from the micro need only have a low-resolution display as it's used purely for displaying program data and Pluto's status. Conversely, the monitor for the Pluto should, ideally, be a top-notch, hi-resolution device in order to get the most out of its 768 × 576 output.

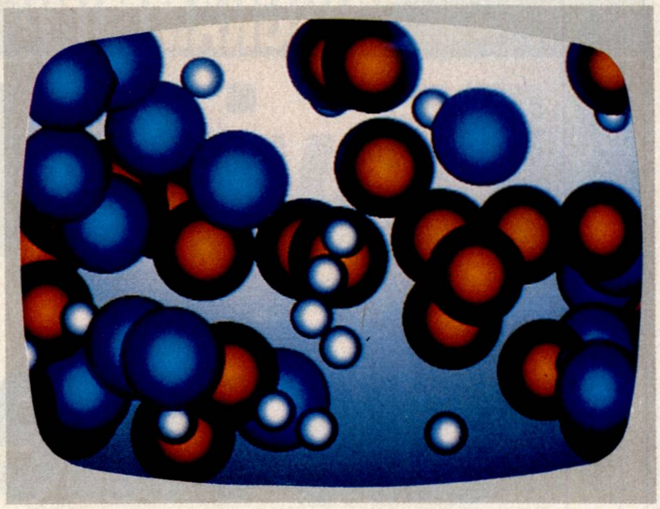
Software

The software published by PLB occupies two sides of a 5¼in floppy disk. On one side are three libraries of programs and test routines, on the other are release notes for Pluto Software Suite and programmer's library documentation.

After connecting the various pieces of equipment and switching on the power, the system is tested with a demo program. If the BBC and Pluto are communicating correctly, the former's monitor will display the message 'press



The ubiquitous goblet is given a novel treatment by a professional artist



Coloured bubbles show the possibilities of shading, effecting an appearance of depth and substance

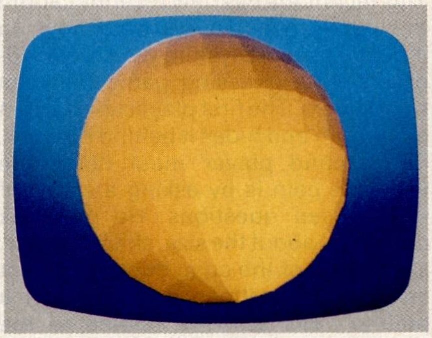
space bar' while the latter's will flash slightly before displaying a colour bar chart.

Of all the programs on the disk, the one that's most accessible to the non-programmer is SGP 1.0. This is a design package that requires no knowledge of computer languages from the user. What you do need, though, is a Calcomp digitiser which connects to the BBC via the RS423 port. Other digitisers can be used, but certain coordinate variables have to be altered with a function called PROCbitpad.

When SGP 1.0 is loaded, the Pluto monitor displays a black screen with a cross cursor in the centre. This is the designer's onscreen paintbrush, and can be operated by moving a pen over the surface of the digitiser. Any moves made by the pen are detected by the BBC and displayed on its screen as a series of x and y coordinates.

Colour is selected from a colour table which, although it doesn't appear on the screen, can be made to do so by moving the cross cursor to the bottom of the screen. The same applies for a main selection menu, except this time the cursor must be moved to the right-hand side. Commands are cancelled by moving the cross cursor to the bottom right-hand corner of the screen. The system is very pedantic about where the cross is placed, and it often required several attempts to get it right.

The main selection menu is divided up into three clearly defined sections. Section one contains all the drawing mode options, which are as follows: Points; Lines; Rubber Lines; Rectangles; Circle and Arc (available issue two); Fill (this is exceptionally fast); Brushes and Quills (this alters the shape of the cursor); User Brush (this allows the user to call from disk a predefined set of brushes, available issue 2); Screen Brush (this allows whole areas of the screen to be lifted and moved to another part of the display); and Characters (this allows text entered from the BBC keyboard to be positioned anywhere on the display).



Subtle blends of light and dark give objects added realism

Section two of the main selection menu contains commands that change the drawing conditions for the aforementioned drawing options. These primarily include options to change the background and foreground colours of the screen, different line styles, and an erase function.

The third and final division includes Save, Library, Restart (available issue two), and Demo.

Whereas SGP 1.0 is aimed at users who know little or nothing about programming, the programmer's library is for those who are rather more ambitious. The programmer's library was provided to give designers a set of easy-to-use procedures which control the operation of Pluto and its palette.

The procedures PLB has created replace the so-called user-callable functions and palette commands introduced by IO Research. These procedures form a major part of the user interface, and perform such operations as shape-drawing and copying parts of the graphic screen; most can be called from within Basic.

Due to these procedures performing some of the most basic functions, they have been termed 'primitives' and take the form PROCname (p1, p2, p3 . . . . . pn) where n is the number of parameters; 'name' corresponds to each of the Pluto processor primitives. A procedure can therefore be thought of as a function which invokes a primitive. To illustrate this concept, PLB's manual uses the primitive SCCol which defines a new current colour. SCCol is invoked by PROCSCCol (n%) where n% is a parameter passed either as an integer to which a value has previously been assigned, or as variable. In a program, the syntax could either be n% = 6 : PROCSCCol (n%) or PROCSCCol (6).

Several commands considered by PLB to be unnecessary to the Pluto user have not been implemented for the BBC. The ones that have been, and there's a lot of them, give the user a lot of flexibility for creating top-quality images.

Missing from issue one of the software, though available in the second, is a frame-grabber routine. IO Research produces one, but due to the compression algorithm used, it is very difficult to save a frame-grabbed image on the BBC. For those who aren't sure, a frame-grabbed image is one that has been input from a camera and stored in the computer's memory. Due to the image being held in the micro's RAM, it can be saved to disk like anything else and changed at liberty by the user. Both PAN and ZOOM are useful for moving around the image, which can be loaded into SGP 1.0 as an ordinary picture file.

Conclusion

I have one complaint about PLB's offering, and that's the documentation. As with IO Research's manuals, the writers apparently have little regard for the general user, so for the most part it is very difficult to understand. On top of that, many references are made to the original Pluto II manual, so a lot of chopping and changing between the two is required if you are going to get anywhere.

Apart from the manual, PLB has obviously made a concerted effort to put the power of Pluto at the disposal of BBC owners, even if it is still expensive.

PLB is at 61/63 Beak Street, London W1R 3LF. Tel: (01) 437 4048. END

Playing by the rules

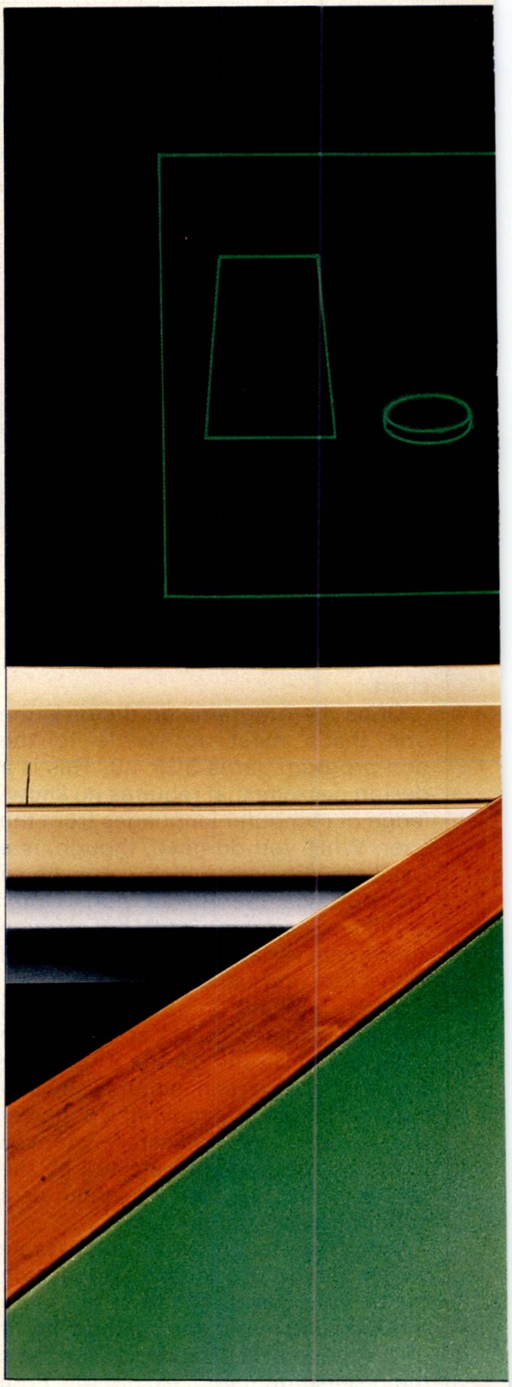
The current knowledge engineering bottleneck, which is retarding the development of expert systems, can be avoided by allowing a computer to work out its own rules about the world. Ed Stenson explains rule induction, a process which does just this.

One of the main requirements of any intelligent system is that it should have an ability to learn. People are very good at recognising and remembering errors of judgement, and applying that knowledge the next time a similar situation crops up.

There are many demonstation AI programs showing the feasibility of computer learning, but few 'real' programs rely on learning techniques. For example, it is very difficult to write a chess program capable of learning chess from scratch in the way a human player would pick it up, or of analysing a game to decide where it had made its mistakes.

However, learning can sometimes be applied to good effect in rule-based expert systems, as illustrated by Donald Michie's recent expert system shell, Expert-Ease (reviewed *PCW*, June 1984). Expert-Ease uses a technique called 'rule induction' to work out its own rules for use in its knowledge base. The knowledge engineer need not supply explicit rules to the system (a method found to be painfully slow when used to develop the knowledge bases for 'conventional' expert systems such as Mycin and Prospector), but instead provides a set of examples of an expert at work (for example, a doctor diagnosing an illness from a set of symptoms) called a 'training set'.

A training set is relatively easy to obtain. Often, a suitable set of examples in a given subject will exist in the subject's literature. Failing that, an expert can usually supply examples of worked problems with relatively little effort, as problem-solving is likely to form a large part of his daily work. The knowledge engineer's work is therefore greatly simplified, as his efforts are restricted to tracking down errors or omissions in the training set. As one leading researcher in inductive systems has put it: 'The lure of induction techniques is the possibility of providing the expert with assistance where he needs it most. The expert will still be responsible for concepts or new ways of viewing objects in the domain and



the rules of thumb for navigating it.' The main obstacle to expert system development, the knowledge engineering bottleneck, is neatly sidestepped as the knowledge engineering has effectively been automated.

Rule induction

This technique has only recently caught the public eye. To illustrate how an inductive expert system works, consider a simple guessing game between two players. The first player takes a coin at random and hides it behind his back. The second player must determine what the coin is by asking a series of well-chosen questions. He may ask questions about the size, shape, colour, and so on, of the coin, but he may not ask direct questions such as 'Is it a penny?'. His score is related to the number of questions he needs to ask; the more questions he asks, the fewer points he gets.

	Round?	Colour?	Portcullis on reverse?	Lion on reverse?	Crown on reverse?	Coin
	Yes	Bronze	Yes	No	Yes	1p
	Yes	Bronze	No	No	Yes	2p
	Yes	Silver	No	No	Yes	5p
	Yes	Silver	No	Yes	Yes	10p
	No	Silver	No	No	Yes	20p
	No	Silver	No	Yes	No	50p
	Yes	Gold	No	Yes	Yes	£1
Least squares coefficients for each attribute	29	21	37	25	37	

Fig 1 A simple training set

Illustration by Stuart McKay

Taking a careful look at a set of English coins, it turns out that five questions are sufficient to identify any of them uniquely:

1) Is the coin round?
2) What colour is the coin?
3) Is there a portcullis on the back?
4) Is there a lion on the back?
5) Is there a crown on the back?

Fig 1 summarises the answers to these questions for the seven coins of the realm and is, in fact, a simple training set. The training set as it stands will not cope with Scottish or Irish coins as they carry different designs, but it could be extended if necessary. If this training set were given to an inductive expert system, a computer could join in the guessing game and would probably beat the average human more often than not.

Each row of the training set is one very simple example (known as an 'instance' in the jargon) of expert decision-making. Each column holds an 'attribute' and its set of 'values'. Colour? is an attribute, taking the values bronze, silver or gold. The right-hand column is the 'decision' corresponding to each instance and is termed the 'class'. Therefore, a coin that is round and bronze, with a portcullis and a crown on the back but no lion, is a penny.

The expert system could simply use a training set as a look-up table. To determine the identity of an unknown coin, the system would ask for the values of the five attributes, search the table for the relevant entry, and print the class it found as its answer, but that's not a very intelligent way to behave because the system seldom needs to ask every question to find an answer. For example, suppose that the first question the system asked was 'What colour is the coin?' and that the reply was 'bronze'. The machine immediately knows that the coin must be a 1p or a 2p piece, and if it can find the right question to distinguish between the two it can identify the coin exactly. However, a 1p has a picture of a portcullis on the back while the 2p does not, so the machine next asks 'Is there a portcullis on the back?' and receives the answer 'Yes'. The computer realises that the coin must therefore be a penny, even though it has only asked two of its five questions. For this particular knowledge base it transpires that a maximum of three questions should always be sufficient to produce an answer (although which three questions depends on the coin itself), but, you may ask, how did the machine know that it should ask about a portcullis at this particular point?

The inductive system works by transforming the training set into a decision tree such as the one shown in Fig 2. It always starts its search for an answer at

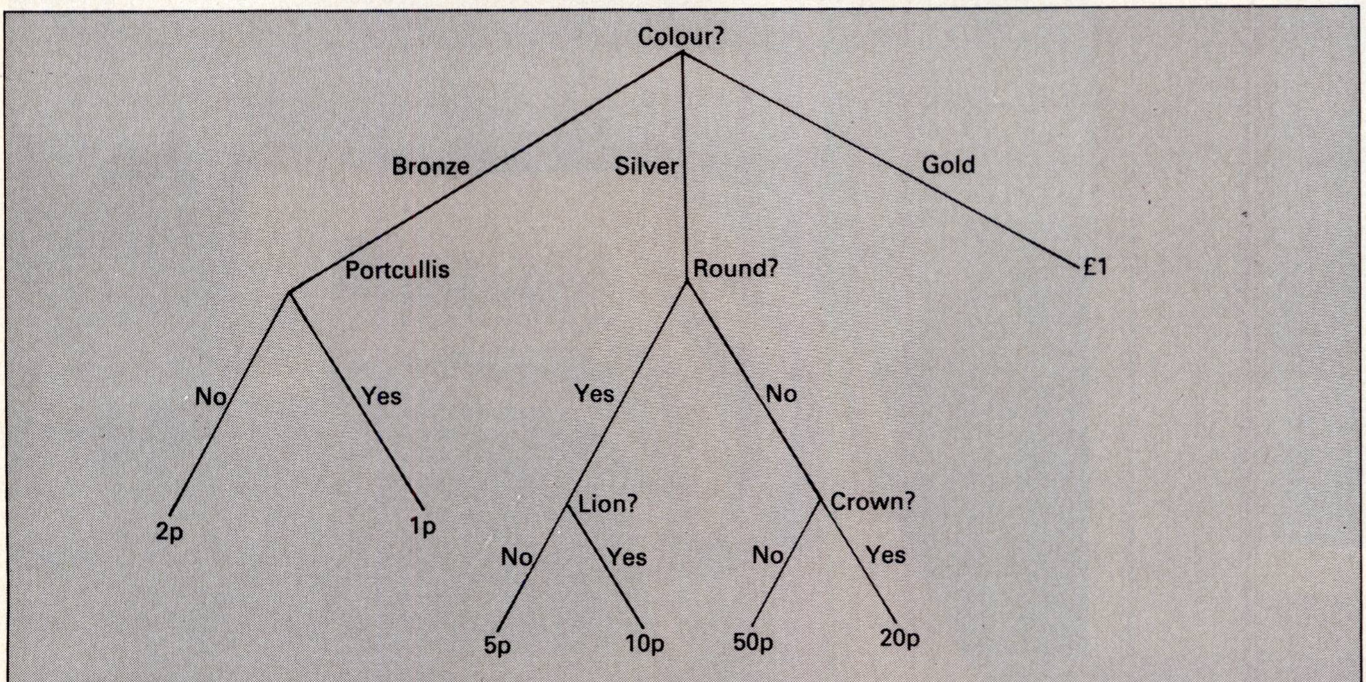


Fig 2 A decision tree for the coins training set

the top of the tree (known as the root, oddly enough) and, guided by the answers it receives, walks down the tree until it reaches a leaf. Each leaf is either assigned a class or marked as a null, the latter indicating a possible gap in the expert system's knowledge. Clearly, the question asked at any stage in the tree depends on the answers to all the previous questions, and this property of an inductive expert system often makes it seem to follow a line of reasoning just like a human expert.

The attribute Colour? is a ternary attribute (that is, it can take three states) and the remaining four attributes are all binary, so the maximum number of leaves that the tree could have in this case is 3x2x2x2x2=48. The expert system makes do with a seven-leaf tree as it recognises that many of the leaves (that is, decisions) simply cannot ever occur. There is no bronze-coloured coin that is not round, for example.

It is this redundancy that an inductive expert system exploits to achieve its apparent intelligence. It's no great crime for the system to ask a stupid question in our guessing game (although it does cost the machine points), but if an expert system in a hospital or on an oil rig was known to ask pointless questions, it would rapidly lose the patience of its users. In a situation where a very quick response is needed, the system must be able to make reliable deductions based on an absolute minimum of evidence.

Do it yourself

Constructing your own inductive expert system (shown schematically in Fig 3) is therefore a matter of writing an editor to allow the training set to be typed in, writing a tree generator (which is easier than it sounds), and writing a routine to ask the user questions and move around the tree on the strength of the answers (which is also easier than it sounds).

Users of disk-based machines will probably store the training set and tree as files; if so, a word processor might be pressed into service as an editor, at least as a temporary measure. Cassette-based machines can hold a modest training set and tree in RAM, a 48k machine being especially useful.

Do not be put off by the AI pundits who insist that expert systems must be programmed in Lisp or Prolog. Procedural languages are perfectly acceptable for inductive expert systems so use C or Pascal if you have them, but do use Basic if not. Lisp and Prolog are excellent for many problems, but cannot really be recommended for inductive expert system implementations.

Many different (but equivalent) trees may be drawn to represent a particular training set (depending upon which question is chosen at each node), but the system must select the best. To do this it uses information theory, a subject that has grown from the field of communications to cover efficient means of handling and transmitting information.

Each question in the tree must be carefully selected to yield the maximum amount of information possible. Let's consider the machine's choice of its first question in the guessing game. Suppose it asks 'Is there a crown on the back?'. Most coins have a picture of a crown on the back, only the 50p does not, so the question seems like a good way of identifying a 50 pence piece. If the expert system gambles that the unknown coin is a 50p, it could ask the Crown? question and, if the coin is indeed a 50p, immediately win the game. However, usually the coin will not be a 50p (six times out of seven if the coins are picked at random) and so, although the question serves to eliminate the 50p, it is generally of little help.

On the other hand, suppose that the system asks 'What colour is the coin?'. If the answer is 'gold', then the machine should think itself lucky and can assume straight away that the coin is a £1. If the answer is 'bronze' then, as stated earlier, just one further question will distinguish between a 1p and a 2p. If

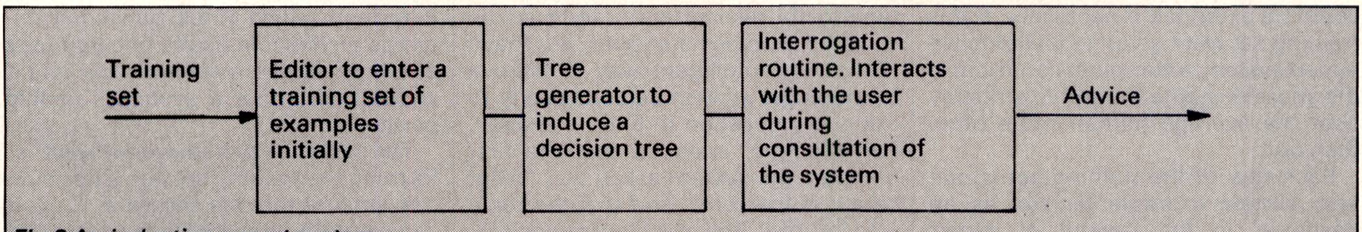


Fig 3 An inductive expert system

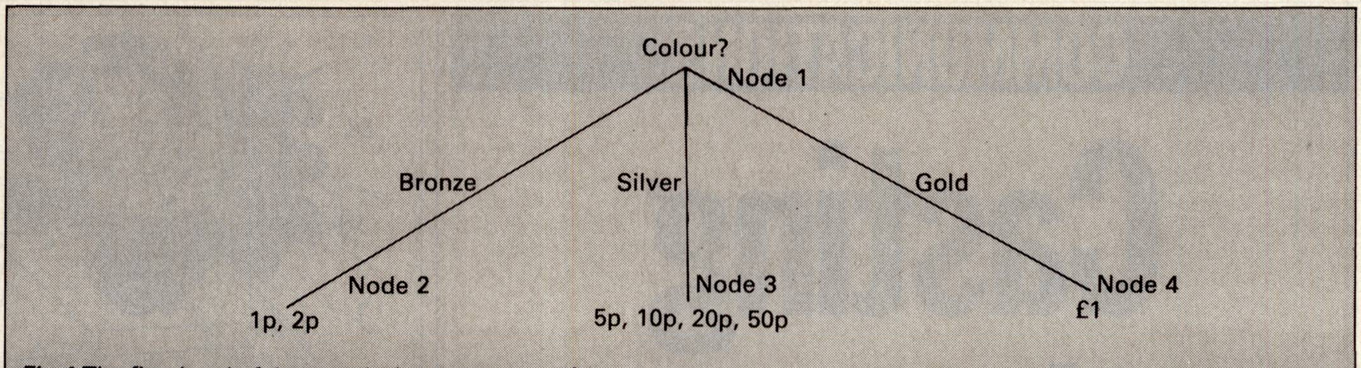


Fig 4 The first level of the tree during tree generation

the coin is silver (5p, 10p, 20p or 50p) then two more questions will yield its identity.

The Colour? question is unlikely to completely identify the coin, but it does give a great deal of information regardless of the answer. The Crown? question tells us a lot about the coin if, by chance, it happens to be a 50p, but otherwise tells us virtually nothing.

How can a computer judge how much information a question will give? Roughly speaking, the better the instances are separated by a question, the better the question. To explain that, the Crown? question separates the seven instances of the training set into two piles; six for yes and one for no. The Colour? question produces three piles: two bronzes, four silvers and one gold, so it tends to separate the instances better. AI is full of rules of thumb ('heuristics' in the jargon). Along these lines, a good heuristic to pick a question is to calculate the sum of the squares of the height of each pile and to pick the smallest (that is, a least squares selection). That might sound involved, but it demands no great mathematical ability. For the Crown? question the answer is:

$$6^2 + 1^2 = 37$$

and for the Colour? question we get:

$$2^2 + 4^2 + 1^2 = 21$$

Colour? gives a smaller answer so, by our rule of thumb, it separates the instances better to give us, on average, more information. A complete set of least squares coefficients for the first question is given in Fig 1. On this basis, Colour? is picked as the first attribute to ask for and the machine can begin to grow its decision tree (Fig 4).

There are now three new nodes in the tree to look at. The instances in the training set are split up by assigning them to their relevant nodes, and the procedure is repeated at the new nodes until a situation is reached where each node has only one class assigned to it. This has already happened for the right-hand node (£1) in our example, so it can be marked as a leaf and henceforth left undisturbed by the tree generator.

On a more pragmatic note, the tree can be stored as a series of forward and backward pointers (with each node pointing to its parent node and to its offspring) although, strictly speaking, forward pointers are sufficient. The nodes can be numbered 1,2,3,4,... as they are created and referenced in this way by the tree-walking routine. A good format to use when storing each node is shown in Fig 5. The node number is noted together with the number of offspring it has (zero if it's a leaf), pointers to each of the offspring, and a token indicating which attribute should be requested by the interrogation routine when it gets to the node. The interrogation routine need simply ask the user for the value of the attribute and use that value to select which of the offspring nodes to move on to next.

Conclusion

There is some debate as to whether an inductive expert system is really an expert system at all. Certainly it is not a conventional expert system (differing as it does from the production system architectures of Mycin and Prospector) but it does employ rules, so it can definitely be called a rule-based system and it is capable of learning. One of the main differences between a Mycin-style system and an inductive expert system is that Mycin uses around 400 individual rules (of the IF x THEN y type) whereas an inductive expert system generates and uses one all-encompassing rule — the tree itself. Also, an inductive system cannot easily explain its line of reasoning in the way that Mycin can, nor can it cope very well with uncertain data. These problems must be addressed if induction is to make a real contribution to AI.

Expert systems are still in their infancy, and no hard and fast definition has emerged as yet.

It remains to be seen exactly what type of fields an inductive expert system might be used within. The matter of selecting which attributes to look at is far from straightforward. The attributes used in the training set for the coins example were discovered by spending five minutes in an armchair looking at a handful of loose change, but it is less obvious what attributes should be used in, say, a medical diagnosis system.

A partial solution is to include any attribute into the training set if it might conceivably be of use (for example, the state of the weather, the FT index, your mother's birthday) as an inductive expert system will automatically ignore an attribute if it has no bearing on the decision process. However, such an approach tends to complicate the knowledge acquisition process (the business of actually finding a training set in the first place) and is really a last-resort measure.

Inductive expert systems alone will probably not form the basis of complete expert systems when the Fifth Generation finally arrives, but they are a good first step on the road to 'AI for everyone' which the Japanese have set out to follow. More importantly though, they seem likely to become increasingly common as add-on rule generation modules for use within conventional expert systems. END

Node number	Number of offspring	Pointer to offspring 1	Pointer to offspring 2		Pointer to offspring n	Attribute
1	3	2	3		4	Colour?

Fig 5 Format for storing a decision tree in tabular form

Casting the net

Peter Wild looks at the results of recent tests on three network systems from Apricot Computers (ACT), LSI and Research Machines, and finds the latter's Nimbus heading the field.

Interest in networking is growing constantly. The obvious advantages such as economies of scale are only one aspect. There is an increasing awareness of the power and common sense of shared peripheral resources and other computing facilities, communications and data access.

Network systems cannot be introduced as a magic ingredient that will solve every problem at a stroke — there are many pitfalls and potential problems. As is so often the case, the first in the field may well suffer the most in terms of teething troubles and other problems; not least of the headaches is the choice of supplier. Those who are looking into networking are often at a loss when it comes to evaluating the many different systems on offer from network vendors. All too frequently, judgements must be made with insufficient experience, knowledge or hard facts available. Seeking professional advice does not always necessarily guarantee the accuracy, impartiality or indeed the expertise required to avoid making expensive mistakes. Introducing a network for the first time entails taking decisions that will have a profound effect upon the future suitability, performance and ease of use of a networking system.

Network evaluation

Coupled with the growth in demand for networks, especially from the business sector, and the increasing user expectations of system capability and performance, this poses a problem. Where can you turn for an objective evaluation of the different hardware choices and software implementations of the many networking systems currently available? Network systems, and the evaluation of their performance, have recently been the subject of intensive scrutiny. The results of some well-defined tests (evolved for the specific task of differentiating between systems from various suppliers) provide an opportunity for objective analysis of their merits (and demerits).

Earlier this year, the Inner London Education Authority (ILEA) set up a committee to examine the performance of current offerings, with a view to recommending a 'standard' system for further and higher education. Its findings make for interesting reading. This is probably the first time that several different networks have been subjected to comparative Benchmarking under the watchful eye of an independent body. Moreover, due to the special requirements within education, the tests themselves are especially revealing of faults or inadequacies in network architecture and implementation.

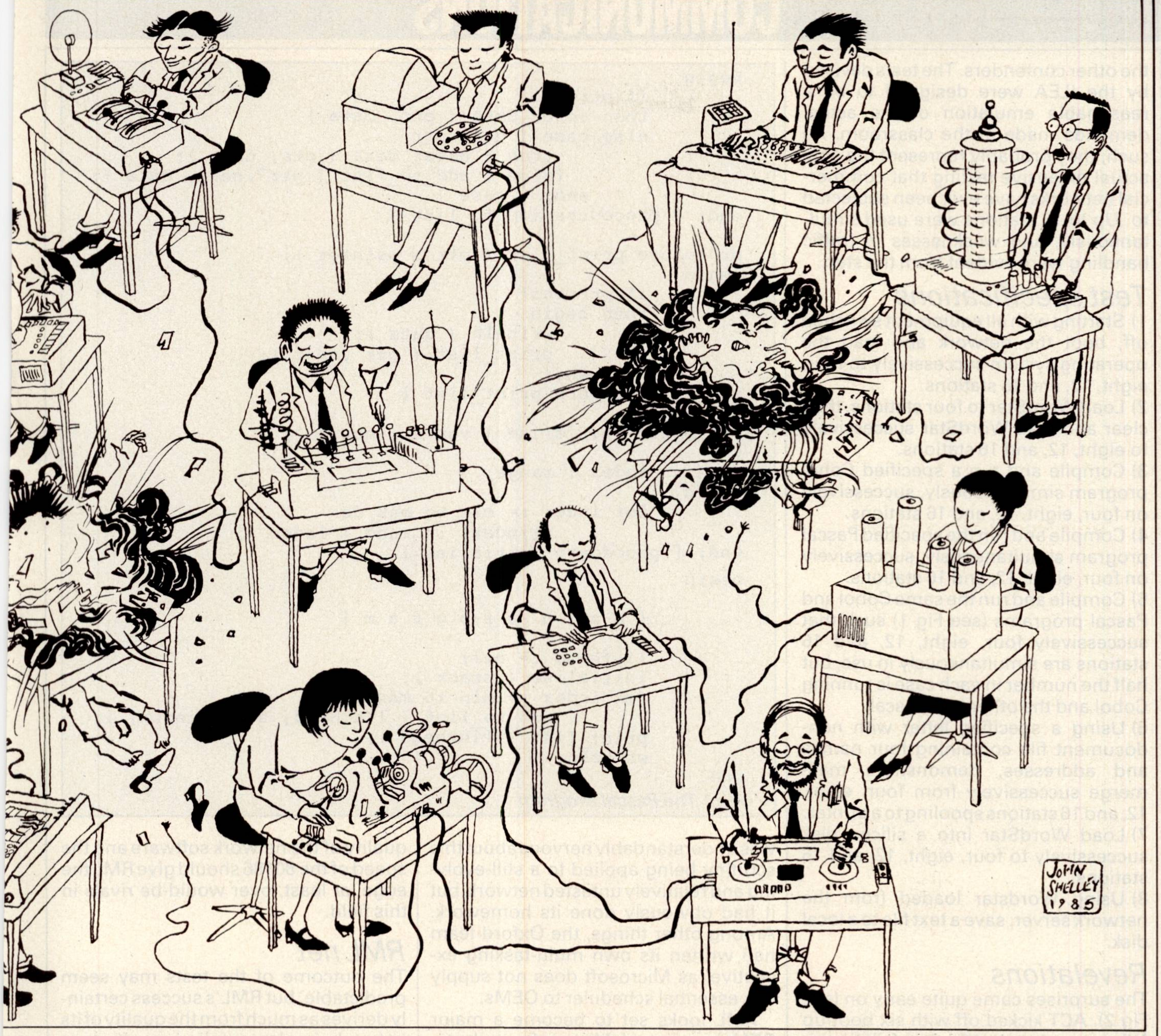
Educational scenario

Network resources are stretched to the limit when confronted with certain situations. In particular, simultaneous demand on disk access and/or printer spooling can place a heavy burden of responsibility on the networking software. Any weaknesses in the system are highlighted when networks are subjected to the exigencies of an educational environment. This is especially the case with regard to the robust behaviour of the multi-tasking schedulers, and problems with contention for access to shared files, data or address buses.

Imagine a typical school or college scenario: a dozen or more pairs of willing but inexperienced (and therefore, invariably, error-prone) hands punching the keyboards into submission is work enough. But, almost uniquely, this type of operation will invariably be required simultaneously. Both at the start of a class and at the end of every session (when programs or WordStar documents must all be saved and spooled to the printer, for example), there is a tremendous peak demand on the ability of the system to handle traffic across the network. This is also, of course, not unknown in business use at the start and end of each morning/afternoon session, but tends to be more evenly spread and so less onerous on the system than is the case in education. The ILEA tests were devised specifically to reveal any weaknesses in coping with unusually high simultaneous demand, and the results of the tests may well help to remove any lingering complacency about the ability of even well-established suppliers to meet the stringent requirements for a secure network.

Perhaps even more so than in business, the range of software needs in education is extraordinarily wide. Word processing, spreadsheets, and so on, naturally, but also everything from Logo to Pascal and 'paint' packages to Cad/Cam are required. With a view to examining technological advances and

Illustration by John Shelley



trends in computing, the Advisory Committee for Computer Education (ACCE) created working parties early in the current academic year. The most important group was the further education working party. Its original findings were not, in fact, startingly original. Broadly speaking, it decided that most software was being produced, at least initially, for the IBM PC. Due to the dominance of IBM in motivating software developers, thoughts concentrated around MS-DOS and Intel-based machines. The specifications finally put out to tender stipulated that the micro should:

1) Run under MS-DOS using 8086 processor technology or its derivatives with at least 1Mbyte RAM maximum memory.

2) Provide colour graphics with a resolution of at least 320×250 in 16 colours, 40 and 80 column text and full teletext.

3) Be capable of operating in network configurations with up to 64 stations.

4) Support Winchester disk storage of at least 40Mbytes.

5) Support both local and central network printers.

6) Be capable of use, by emulation or otherwise, as a remote terminal to a mainframe computer.

The committee also asked for salient information on all aspects of the system, both hard and soft. The detailed pricing requested was for complete network systems, including the software. Word processors, spreadsheets, drawing packages and other applications had to be quoted for separately, if not bundled with the system. The wide range of quotes, sometimes for the same product, raised a few eyebrows. Languages considered essential were Pascal and Cobol for Business Studies courses. The ability to network was, of course, mandatory.

At this time, RML (Research Machines Ltd) had been supplying the robust 380Z machines and 480Z networks for most educational needs, although there were a number of BBC Model Bs and Acorn networks around. Performance of the Z80-based network had been responsible for some growing dissatisfaction, and RML had not yet unveiled the 80186-driven Nimbus. Several manufacturers were considered, and many were discounted due to high cost or poor specifications. IBM, Olivetti, Sinclair and Acorn bit the dust early on these grounds. Others were called but few, to borrow a phrase, were chosen.

The contenders

There were three firms short listed to present their networks in action. Apricot Computers (ACT) was chosen together with LSI's Octopus (8088) and the then unreleased RM Nimbus. ACT has made a strong marketing bid for the educational sector with the 8086-based F1e running MS-DOS. Both it and RML OEM Microsoft products, including MS-NET, and both firms have a competitive pricing policy. This was distinctly to the disadvantage of LSI, whose quoted complete network price (around £70,000) was over twice that of

the other contenders. The tests devised by the ILEA were designed to be a reasonable emulation of the actual demands made in the classroom. As such, they probably represent the only actual extensive testing that commercial networks have ever been subjected to. Up to 16 stations were used simultaneously, and weaknesses in traffic handling were evident from the start.

Test specifications

1) Starting with all equipment switched off, boot the network and load the operating system successively to four, eight, 12, and 16 stations.
2) Load WordStar to four stations, then clear and load WordStar successively to eight, 12, and 16 stations.
3) Compile and run a specified Cobol program simultaneously, successively on four, eight, 12, and 16 stations.
4) Compile and run the specified Pascal program simultaneously, successively on four, eight, 12, and 16 stations.
5) Compile and run the same Cobol and Pascal programs (see Fig 1) such that successively four, eight, 12, and 16 stations are simultaneously in use, but half the number in each case is running Cobol and the other half Pascal.
6) Using a specified letter with non-document file containing four names and addresses, demonstrate mail-merge successively from four, eight, 12, and 16 stations spooling to a printer.
7) Load WordStar into a silicon disk successively to four, eight, 12, and 16 stations.
8) Using Wordstar loaded from the network server, save a text file to a local disk.

Revelations

The surprises came quite early on (see Fig 2). ACT kicked off with six boot-up failures and up to 10 other failures on some tests. The fact that nine recoveries were effected on the sixth test was due to a helpful 'Abort, Retry or Ignore?' message from MS-DOS. LSI, with a much more expensive system, also suffered large-scale failure, and only managed to negotiate test 2 (the first WordStar test) without incident. It began to look as though the ILEA was going to have a problem finding that rare species of the genus network, the working variety, never mind eager thoughts of tracking down one of the speedy variety. Fortunately for us all the next set of tests showed a dramatically different scene. The Nimbus network not only took the preceding two contenders to the cleaners when it came to Benchmark times, but only suffered the indignity of one failure throughout the tests. This was on the simultaneous Cobol/Pascal test.

Interestingly, I understand that the specified programs (presumably written by ILEA lecturers) both contained errors (see Fig 3). Research Machines

```
begin
        if ptr=nil
        then enter_data ( ptr, data )
        else case ( data<ptr )
                true : enter_data ( ptr, data );
               false : add_to_list ( ptr^.next, data );
             end; { case }
end; { procedure add_to_list }

procedure print_list ( ptr : pointer );
begin
        if ptr<>nil
        then begin
                writeln ( data );
                print_list ( ptr^.next );
             end;
end; { procedure print_list }

procedure initialise ( var s : queue );
var
        index : range;
begin
        for index := min to max do
                s[index] := rand ( index );
end; { procedure initialise }
begin

        { m a i n   p r o g r a m }

        listhead := nil;
        initialise ( stack );
        for index := min to max do
                add_to_list ( listhead, stack[index] );
        print_list ( listhead );
        writeln;
end.
```

Fig 1 The Pascal program

was understandably nervous about this scrutiny being applied to a still-evolving and relatively untested network, but it had obviously done its homework. Among other things, the Oxford team had written its own multi-tasking executive, as Microsoft does not supply this essential scheduler to OEMs.

RML looks set to become a major OEM supplier of Microsoft products, and is looking to the business sector for expansion. The Nimbus (Benchtested in *PCW*, April) is an undoubtedly well-engineered system, from all points of view, and offers IBM PC/AT credentials at half Big Blue prices. The choice of the 80186 is unusual — most other clones are going for the 286 which has greater hardware capabilities, but at the expense of simplicity of design. The Nimbus system sucessfully implements password protection, file sharing and record locking. It uses the CSMA/CD access protocol on a cheap but reliable 50-ohm coaxial cable system that is opt-isolated from the hardware. Risk of damage due to cable malfunction and the possibility of jamming are greatly reduced on this type of passive system. Bandwidth is 0.8Mbit, about 75 per cent of which is utilised, giving around 60k bps data transfer (that's as fast as it comes off the hard disk). Highly intensive sessions with a large number of active stations will slow down any network, but the quality of the network software and the speed of the 80186 should give RML the edge, at least, over would-be rivals in this field.

RML net

The outcome of the tests may seem predictable, but RML's success certainly derives as much from the quality of its network implementation as it does from the powerful 80186 inside the Nimbus.

Insistence on a 720k double-sided local disk for each station (RML's minimum disk configuration) weighted things against ACT. The £300 extra cost for the double-sided Apricot disk means a significant £4800 jump in the price of a 16-station network. In addition, one Mbyte of RAM may, arguably, be seen as an excessive requirement, and one that disfavours machines limited to 640k without costly expansion kits. However, the Nimbus performed superbly in comparison with its competitors, despite the fact that RML had planned the development program to mature in August. The tests had been slightly rescheduled to accommodate this, but nevertheless took place in mid-June when the network system would normally have still been under wraps. The most important facet of the figures now available from the ILEA's tests is not that the Nimbus outperformed its nearest rival by a factor of

between two and four times in speed. Rather, it is the notable absence of embarrassing moments — only one failure throughout the tests. ACT notched up over 30, and LSI (despite its longer experience of supplying commercial networks) achieved an indeterminately large grand total.

Conclusion

It is clear that there are several important factors to be considered if the essential reliability and performance of a network system is to be achieved.

RML's use of the Intel 80186 processor shows quite clearly the benefits of this processor's speed over the 8086. Without doubt, powerful chips such as the Motorola 68010 and Intel's 186/286/386 are mandatory for a network file server, if not for the stations. The 8088 can no longer be seriously considered.

In the case of the 80186, a significant cost saving may be realised due to its 'all on board' architecture. The other sophisticated chips in the Intel family require several peripheral support chips and greater complexity of printed circuit board design.

The advantage of having the protection of memory segments in hardware has meant great interest in the Intel 80286 chip (and attendant problems of supply, of course) but RML has adopted a soft solution with the Nimbus system. The ILEA test results testify to the merits of this approach, and the resulting lack of complexity in hardware terms is an attractive proposition. Problems that surface during the life of any system are much more difficult to resolve if hardware modifications are required.

Given a well-designed and implemented operating system, the additional burden of handling network needs can be eased considerably if plenty of memory is available. This is especially so for the server, but stations as well as stand-alone machines can be improved with the provision of a healthy amount of RAM. The advances in fabrication technology and the decreasing price of memory chips continues to reinforce the advisability of not skimping in this area. For example; current products such as DR's GEM and MS Windows need a good deal more than the once-standard 128k.

Whenever we consider advanced hardware, there is inevitably a danger that this glamorous side of computer technology will distract us from what is by far the most fundamentally important consideration. Especially with sophisticated and powerful network systems, it is the quality of the software engineering that really matters. No amount of fancy high-speed chippery or complex hardware protection schemes can provide the standard of performance necessary without the solid base of thoroughly well-designed and tested network software. Speed of response is eminently desirable, of course. Integrity and the robust behaviour of a complete system is essential. RML must continue to build on the solidly-engineered Nimbus system, and with its recent competitive trend in pricing.

A little marketing effort from this comparatively low-profile British company, and business and other sectors of the market are going to wake up to the quality merchandise that is available on their doorstep. END

Time in min.sec

	ACT				LSI				RML			
	4	8	12	16	4	8	12	16	4	8	12	16
1	1.06	1.11	1.24	1.24	1.40	0.58	1.50	3.30	1.30			5.00
	6 boot failures 10 test failures probably didn't exceeed 8 stations				large scale failure with 16 stations				primitive system simultaneous boot not ready : one at a time			
2	1.01	1.45	2.15	2.45	0.29	0.45	0.50	1.10	0.15	0.20	0.23	0.24
	WS loaded only 1 processor replaced 1 test failure ?				WS+document create all tests OK				WS+document create			
									0.31	0.55	1.24	1.30
									separate and tog. max 15 stations			
3	2.00	4.20	6.40	9.00	1.20	2.30	4.00	5.46	0.53		1.35	2.10
	1 test failure IR trouble ?				1 net trans. failure				compile and run max 15 stations			
4	4.50	9.00		18.0	1.45	3.15	4.30	6.40		2.38		4.42
	2 operator errors poor recovery				7 failures *				compile,link, run max 15 stations			
5	4.00		10.3		1.43	3.19	5.47	****	1.29	2.03		3.45
	all tests OK				2 failures * all failed *				1 failure due to 15 station max			
6	4.15	5.00		8.00	1.30			4.00	2.18	2.48		
	10 failures 9 recovered				1 failure queuing problems				temporary 8 station max			
7	1.00	1.30		2.50	0.26	0.57	1.05	1.40		0.48		1.40
	1 failure probably operator error				2 failures				16 stations			
8	1.00		1.10		0.55		0.55	1.17		0.49		1.04
	all tests OK				1 failure				16 stations			

Fig 2 Summary of the network tests time in minutes and seconds

```
begin
  if ptr = nil
    then enter_data ( ptr, data )
    else case data < ptr ^ . data OF (*** 2 corrections ***)
             true : enter_data ( ptr, data );
            false : add_to_list ( ptr ^ . next, data );
         end ( case )
end; ( procedure add_to_list )
```

Fig 3 The correct syntax for the Pascal segment that contained the errors is listed above. The Pascal CASE . . OF construct as shown in the ILEA program had the essential OF missing, and the Boolean expression was enclosed in unnecessary brackets. The original condition compared a data item with a pointer (ptr) instead of the data field of the record. Both these errors would be detected by even a poor-quality compiler, never mind an ISO validated one.

It is rather quirky to use a CASE construct for testing a Boolean expression, in any case (sic) — a nested IF statement would be more natural. The algorithm is also rather strange. An array is used to store 10 numbers, but a dynamically allocated singly-linked list is used for insertion sorting.

SCREENTEST

Homepak

Integrated software (word processor, database and communications), the like of which is common for business micros, is now available for home users in the shape of Homepak from Batteries Included. Nick Walker assesses its capabilities.

Serious software for home computers has, in recent years, followed trends set by its more powerful business micro cousins. This has two disadvantages: firstly, as business software has become more complex, the equivalent home version has had less success in mimicking it; and secondly, the needs of home users are different from office business users.

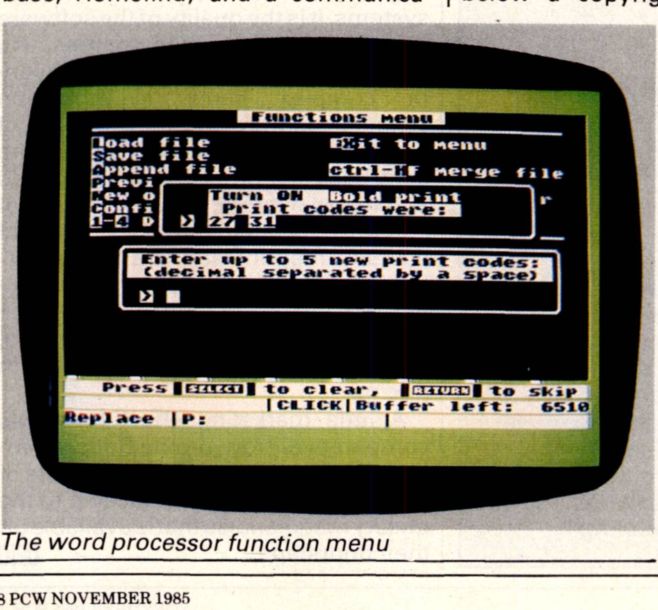
I wasn't surprised, after last year's trend towards integrated packages for business micros, to hear of an integrated package for the Atari, Commodore 64 and Apple II called Homepak. I did, however, have reservations about its capabilities when running on a home computer, and, given the complexity of integrated packages on business computers, I also doubted the usefulness of such a package for the average home micro user.

Homepak consists of three elements: a word processor, Hometext; a database, Homefind; and a communications package, Hometerm. All three programs come on one single disk and, interestingly for Batteries Included, a company that normally uses dongles on all its programs, the disk is not copy-protected (apparently this is at the express wishes of the programmer).

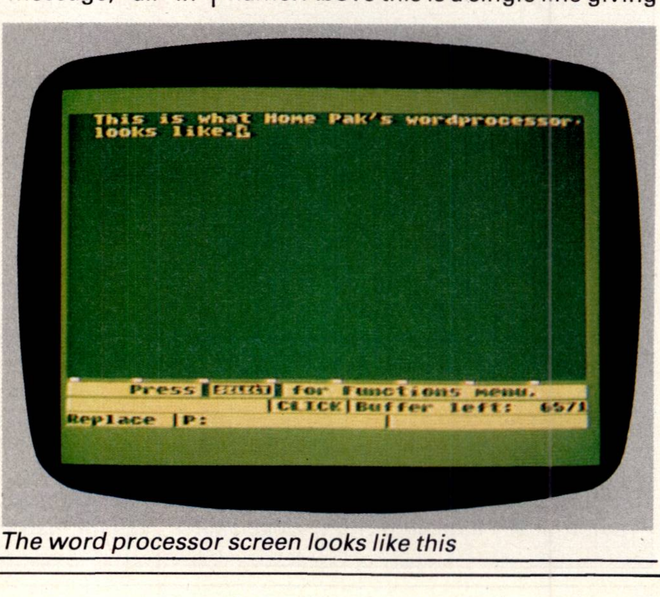
To get started with Homepak you need three blank disks, one for a copy of the programs and two for data. Two data disks are needed as the database uses a special format to allow fast retrieval; the second disk will contain word processor files and downloads from online systems. Booting up your copy of the program results in the main menu offering the three programs. It is immediately obvious upon seeing this screen that the programmer, Russ Wetmore, has his roots in writing games programs. The three options are in different colours, with a different note played as you select each option. Above the options is a title bar and below a copyright message, all in suitably colourful graphics. Homepak was written in a programming language called Action!, a Pascal and C-like language available on cartridge for Atari micros. It's unusual these days for software for a home micro to be developed on the machine itself, and when it is, it's usually in assembler. Action! is the only high-level language I'm aware of that can truly be used to develop commercial-quality software or get results as good as those written in assembler.

Hometext

Upon loading the word processor you are taken straight into the editing screen, at the bottom of which is a status bar consisting of six areas which provide information about the following: current filename of text; key click on/off; amount of memory left for document; replace or insert text; current output device; and merge filename. Above this is a single line giving

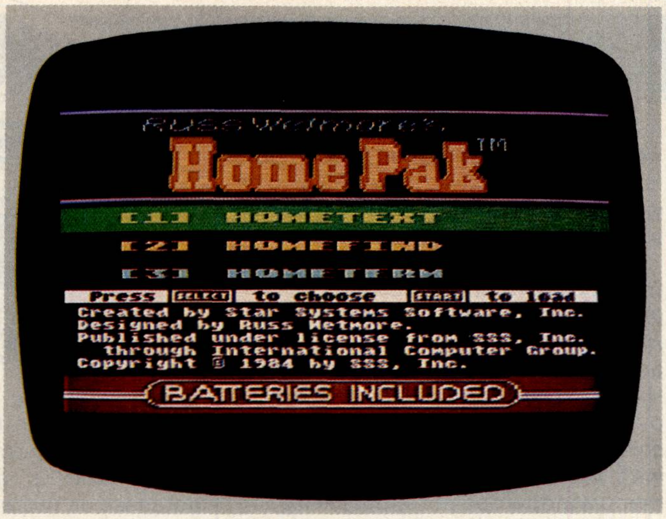


The word processor function menu



The word processor screen looks like this

Windowing on the word processor



The Homepak opening menu

information relevant to the operation you are performing at any time.

The most restrictive feature of Hometext is that it is RAM-based. On the Atari, this means the grand total of 6350 bytes free for documents. To some extent this is compensated for by the excellent facilities for chaining documents and, given the program's friendliness, it doesn't prove to be a major restriction. Text entered while in this screen will be displayed in the upper portion of the screen and will word-wrap.

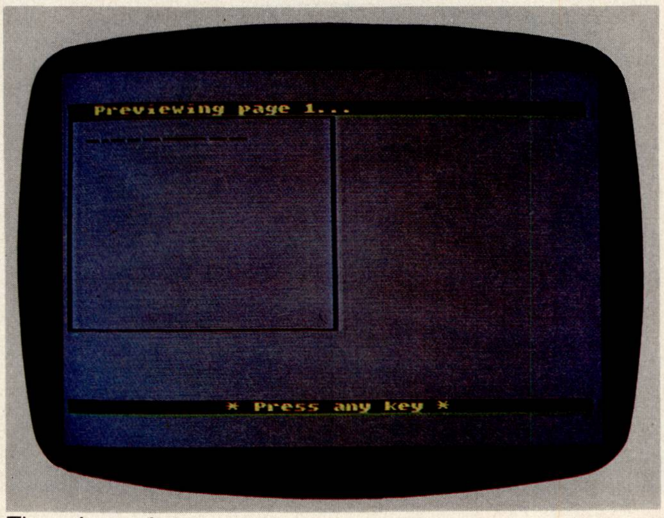
Movement around text has been influenced by WordStar, being achieved by pressing the CONTROL key followed by an alphabetic key. The position of the alphabetic key on the keyboard gives an indication of which way the movement will be. It's possible to move to the top and bottom of a document; move to the top, bottom and middle of a text screen; and scroll a screen of text backwards and forwards. In addition, the cursor control DELETE and INSERT keys work in the usual manner. You can toggle between replace/insert mode using the inverse key (Commodore key on the Commodore). The colour of the border changes to signify which mode you're in — definitely the touch of a games programmer.

The three console keys START, OPTION and SELECT (function keys on the Commodore) will bring up three menus. Loosely speaking, START is used for block manipulation commands, OPTION for printer-related options and SELECT for everything else.

The block manipulation menu comes up as a window on top of the text and offers four options: move text, delete text, copy text and find string. The first three options allow you to define a block of up to 960 characters and then perform the required operation; the fourth option will find any string and replace it with another. With all the operations the status line provides information to guide you if you need it, and windows over the text appear for such things as error messages. Again, the influence of games programming shows, and in general is very well used. For example, while performing a search-and-replace, a bell is sounded each time a word is found, giving an audible confirmation of the number of words replaced.

The printer menu also appears as a window above the text, but unfortunately it has too many options to discuss each in great detail. As well as the usual operations provided with all word processors, there are operations you'd normally associate with professional word processors, such as headers, footers and different types of justification. It's also from this menu that you place markers to signify the merging of information from a file created by the database (mail-merging, to use the technical jargon).

Unlike the others, the third menu is a full screen in itself. From here, you access miscellaneous housekeeping activities such as loading from disk, saving to disk, obtaining directories and starting a mail-merge run. One of the most impressive and useful features of Hometext is accessed from this menu — the print preview feature. Home computer word processors usually have a problem due to the limited line length needed to work with a television (usually 40 characters), so you can't get a feel for how the final document will look when printed out at 80 columns. Print preview graphically illustrates what your page of text will look like when printed, using dotted lines to replicate each line of text and highlighting any special features (extended and bold-face words or characters are shown in blue, underlined words have a green line beneath them, normal words or characters are printed



The print review screen

An example of the friendly database

in black). Due to the amount of memory needed for this operation, documents larger than about two pages have to be saved to disk and the filename specified to the print preview option.

One common criticism of user-friendly menu-driven software is that when you are familiar with the commands, the menus become redundant and slow down your progress. Hometext has a particularly nice way of overcoming this: if you keep the console key pressed down and follow it with the required function letter, the menu window doesn't appear — a good way of tailoring the amount of help to the skill of the user.

The Homepak disk contains a number of special files with a .SET extension, called configuration files; one for each program on the disk. These are records of the current screen colours, brightness and text brightness, margins, key click sound and other features specific to each Homepak program. For Hometext this also includes default tab settings, shiftlock and three printer control codes.

You can change these features to suit your own use and save the changes back onto the program disk by an option from the general menu. When you next load the program, the new settings will be loaded automatically, giving some degree of customisation.

Homefind

The general concept of a database is of a number of records, each consisting of a rigid framework of entry lines called 'fields' which, when they have been established, usually remain fixed in size and cannot be changed. If you approach Homefind with this established idea of what a database should be, you'll struggle. But you approach it with the attitude that all you want to do is type in the relationship between items of information and at a later date retrieve that information, you'll find Homefind a superbly simple database which is ideally suited to the kind of use you might apply a home database to.

Homefind is a natural language database or, more accurately, a natural language information manager — you enter information in the way that it naturally comes to you. For example, if you are entering phone numbers you'd type 'Rob Smith's phone number's 734 6517; if you then want to retrieve this information you'd type 'What's Rob Smith's phone number?'. All you have to learn is the simple format used to enter data and you have a remarkably powerful database, considering how easy it is to use.

The main screen for entering and retrieving information is as similar to Hometext as possible, considering that this is a database and not a word processor. The general operation is the same (that is, console keys for menus, and so on) making it very easy to use. The screen is composed of four areas: the largest area at the top of the screen is where information from the database is presented to you. Below this is a single line giving prompts and information in a similar way to Hometext, plus four lines which display your entries and enquiries. At the bottom of the screen is a status line with five areas displaying the following information: the name of the database disk; printer on/off; the data drive number; key click on/off; and the amount of disk storage left for information.

The initial screen will prompt you to insert a data disk or create a new one. Each database is contained on one disk and one disk only, which can't be used for any other purpose as the data is stored in a special format to allow fast access when retrieving information. To continue with our example, if the database hasn't previously been told about Rob Smith or phone numbers, typing in 'Rob Smith's phone number's 734 6517' will result in the response 'Rob Smith's news to me! New Subject Y/N?' and a similar response for the phone number. Answering 'Y' to each response will add the information to the database, and from now on the database will accept information about Rob Smith without questioning his name, and will accept phone numbers without querying what they are.

The apostrophes are absolutely essential as they break any entry into subject, tag and objects, in that order. In our example the subject is Rob Smith, the tag is phone number and the object is 734 6517. From this, Homefind creates one index for each, and you can ask for information on any one. Entries are not restricted to one line so addresses, and so on, can be shown as usual but still represent just one object. For example: you could type:

Rob Smith's address's
25 Linden Road,
London,
W1A 2HG.

using the down arrow to signify a new line.

When you have entered sufficient information, you will want to retrieve it. Typing 'Who's Rob Smith?' will result in the database telling you all it knows about Rob Smith — his phone number, his address and anything else you may have entered. If you type 'What's Rob Smith?' or even just 'Rob Smith', you'll get the same response. You can make requests referring to tag's or object's, for example typing 'Phone Number's' would list all the phone numbers you've typed in. If you ask for something that's

The database function menu

The online terminal screen

not on the database, your request will be turned into a question which, if you answer, will then be added.

The database will make all the logical deductions that it can. If you type 'Rob Smith's nickname's Bobby', you could then ask 'What's Bobby's address' and the database would understand. It's surprising how much the database can learn from you typing in what seems to be unrelated information: as part of this review I entered my software collection into a database, and was frequently amazed by its correct answers to vague questions.

Homefind doesn't provide a fancy report generator like most programs — a simple printer on/off toggle is all you get. It is clever enough to only print what's relevant and print it in an understandable way, which will probably be sufficient for most uses. If you really want a report, some fiddly manipulation in conjunction with Hometext can be made to generate it.

Pressing SELECT (F5 on the Commodore) will bring up a menu of housekeeping functions in the same way as Hometext. From here you can change the data disk, generate a new data disk, clean up information on a disk, make back-up disks, and perform other assorted functions.

Due to the special disk format used by Homefind, a special function is provided to create normal DOS files for use with Hometext's mail-merge option. A search request peruses your data and forms the response in memory, which can then be saved as a normal DOS file. Files from other databases and word processors (including Hometext) can be used, providing they are edited into the correct format.

Hometerm

If I thought Hometext and Homefind were comprehensive packages, they are outshone by Hometerm. Hometerm has just about every feature that a terminal program should have, including some that you don't appreciate until you need them and find that Hometerm contains them.

Hometerm supports 300/1200 baud operation, has ASCII and ATASCII translation modes (and the equivalent Commodore translation), will upload and download via a very comprehensive implementation of the XModem Christensen protocol, and uses dumb loading for capturing text.

After loading Hometerm from the main menu you'll go directly into the terminal screen. Three screens make up the Hometerm package, the other two being menus obtained by two of the console keys (function keys on the Commodore). The terminal screen initially looks exactly the same as the word processing screen, with a large area for text, a single line for prompts, and a status bar containing the following information: a timer measuring how long you've been online; the amount of memory remaining; baud rate; duplex setting; filename (if any); and the ATASCII or ASCII mode. I especially like the inclusion of a timer, a feature normally only found on more expensive comms packages and useful for commercial systems which charge for their services.

Pressing SELECT (F5 for the Commodore) will take you to the function menu. There are so many features available with Hometerm that not all are shown in this menu: for some of the more obscure ones you have to consult the Homepak manual. Needless to say, Hometerm offers the usual facilities, but I'll concentrate on the aspects that make it stand out from the rest.

First is a macro facility (a macro in communications terms is a series of commands that can be sent with a simple keystroke). Using this it is possible to automate your signing-on procedure or any sequence of commands you commonly use, thus saving time and very often money. Hometerm has 10 user-definable macros available at any one time, and you can have as many sets of macros on disk as you wish. Other systems provide this facility, but what sets Hometerm apart is that the commands are 'smart' macros. They send characters, pause and wait for a response from the host, then continue to send characters. Macros can be chained in any order you require, which means, for example, that you can put the phone numbers of different bulletin boards in macros 1, 2 and 3 and then put a sequence which works on all bulletin boards of a certain type in macro 4. Whichever phone number you choose, you can chain macro 4 and use the whole sequence. Other advanced controls of macros include options to include delay rates or automatically to open and close the capture buffers, all from within one of these smart macros.

If this seems rather complex, it's important to realise that you can ignore the intricacies of these features and just use the defaults. They allow you to load the program and be online with the absolute minimum of effort. However, where other 'user-friendly' programs are soon outgrown by their users, this one keeps up every step of the way. If you need more features than Hometerm provides, then it's time to buy a micro running expensive specialist communications software.

Two features of Hometerm that are worthy of mention are word-wrap and windowing. Word-wrap can be toggled on and off, and when on will work in the same way as word-wrap on a word processor. If you log on to a system that was really designed to be used by 80-column displays, you can switch on word-wrap and avoid splitting screens in the middle.

Windowing really comes into its own when using the interactive chat, or CB facilities, of a large system. When a dozen people are talking at the same time, the words can be flying so fast that it's difficult to tell if the sentence you're about to send is correct. The windowing facility allows you to build your sentence in a separate window, edit it as required, and only when you press RETURN is it sent.

Text captured from Hometerm can be saved as a file which can be read and edited by Hometext. At any point you can switch the output so that it not only goes to the screen, but also to a designated file. The ability to switch this on and off while online means your file can contain only the relevant pieces and not all the paraphernalia usually associated with online systems such as logging-on information.

Hometerm, like the word processor and database, also has a .SET file which allows you to configure the defaults to your own preferences.

Prices

Homepak is distributed by Ariolasoft, and costs £34.95 for the Commodore 64 and eight-bit Atari machines and £39.95 for the Apple II version.

Conclusion

For £34.95 you get an excellent word processor, an unusually friendly yet fairly powerful database, and the best terminal program I've seen for a home micro. Each one of these programs is worth £34.95 by itself — together they represent what can only be described as a bargain. In my case, Homepak has replaced three pieces of software costing a total of £140, and only one of these could be considered as good as its Homepak equivalent. My only criticism is the small amount of memory available to the word processor, but even that is insignificant when you consider its ease of use.

I applaud the programmer's decision to make the program unprotected, and hope that at this price users will buy it in preference to obtaining an illicit copy. If you own a Commodore 64, Atari or Apple micro, Homepak deserves to be part of your software library.

Homepack was supplied by Software Express International. Tel: (021) 384 5080. END

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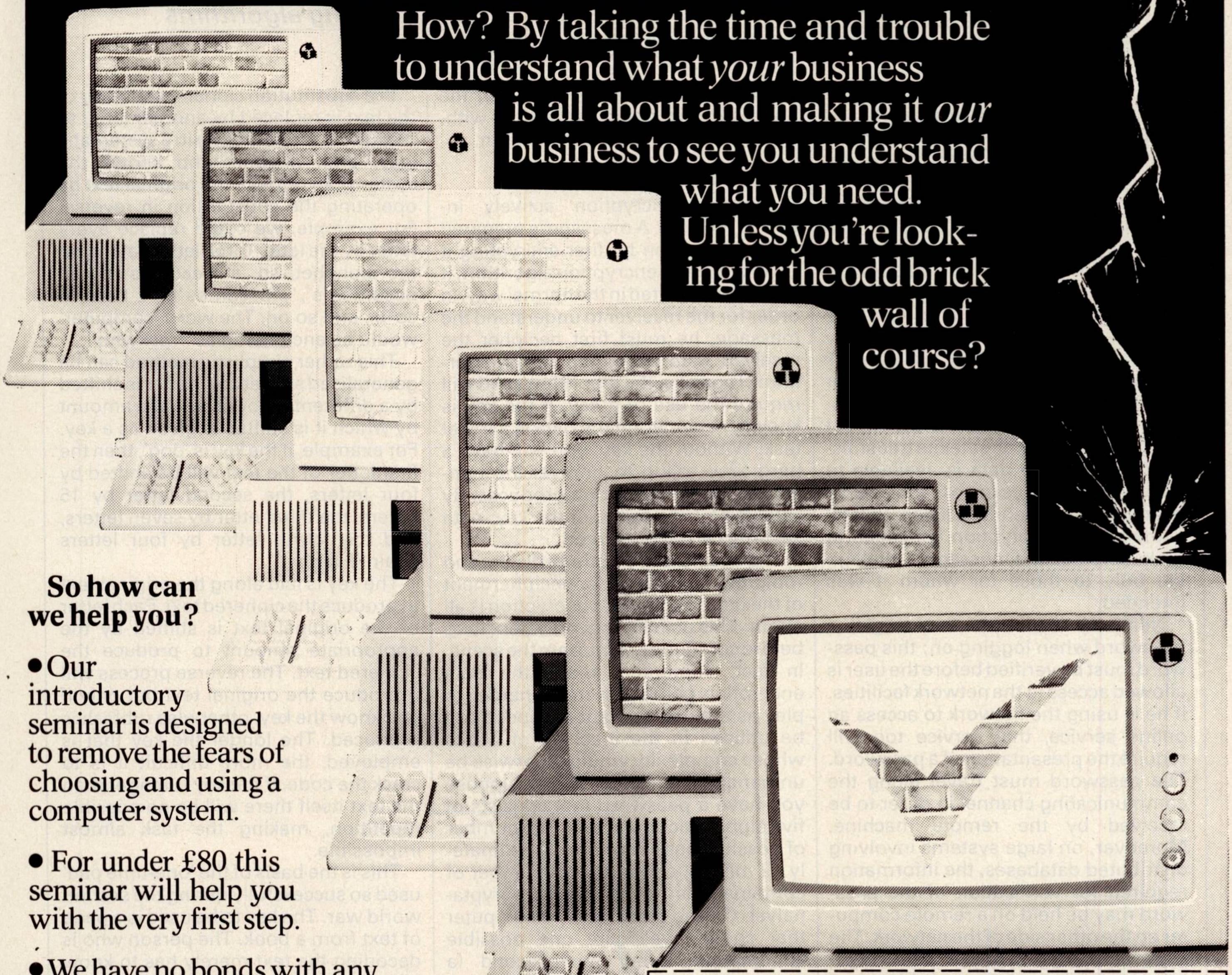

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The hidden meaning

Data encryption need not be exclusive to tales of spying and espionage — it can be a way of protecting your networked data from prying eyes. Yoel Silver describes the methods involved for a micro, using algorithms and a cipher program.

With the interconnection of single computers into local area networks and the interconnection of local networks to form large inter-networks, computer systems are gradually replacing the traditional forms of communication. Electronic mail is on the increase, and even small firms are now using the medium for the transmission of sensitive material.

No-one can manually police the millions of bits of data that are daily being transmitted along the network channels of the world. The potential for eavesdropping is enormous: wiretapping is far more common than most people realise. When satellite transmission is used, the data is available to anyone who wishes to go to the trouble of erecting an antenna to listen. Clearly some kind of encryption is needed to make sure that the message is intelligible only to those for whom it was intended.

Networks require the user to give a password when logging on; this password must be verified before the user is allowed access to the network facilities. If he is using the network to access an online service, that service too will require the presentation of a password. The password must travel along the communicating channel in order to be received by the remote machine. Moreover, on large systems involving distributed databases, the information required for verification of the password may be held on a remote computer on the other side of the network. The local computer sends a verification request to the remote machine and waits for a reply before confirming or denying access. The original password may therefore travel many hundreds of miles along network channels before being verified. Anyone listening in gets the password for free!

Increasingly large computer networks are using encryption to code the data transmitted along their channels. This procedure, known as data link encryption, is a requirement of the system, not of the user. The packets sent along the channel will be enciphered by the sending computer and then deciphered by the remote host. All of this is transparent to the user, the entire process being carried out without his knowledge or participation.

Algorithms

End-to-end encryption actively involves the user. A message is prepared for transmission by first encrypting it according to an encryption algorithm; it is then transmitted in the normal way. In order for the receiver to understand the message, he must first decipher the received data using the same algorithm. Typically, the algorithm used will require the use of a key. If the key is known, deciphering the data is a trivial task. Without the key, you will have a hard time trying to unravel the nonsense that the algorithm produces. By restricting knowledge of the key, data security can be preserved.

The business of creating efficient and foolproof algorithms for encipherment of the data is what data encryption is all about. This activity was prevalent long before computers came onto the scene. In fact, computers make the data encryption game that much harder to play as their computational speed can be utilised in the cracking of codes whose complexity would otherwise be unmanageable. For example, suppose you have a password that consists of five alphabetic characters. The number of possible passwords is approximately 12 million, an inordinate number of combinations for a human cryptanalyst. On the other hand, a computer that could investigate one possible combination every microsecond (a reasonable speed) would take only three hours to exhaust the possible combinations, so on average it would take only 90 minutes to crack any password.

Computers have advantages for the cryptographer as well. Using a computer, the tedious task of coding and decoding data can be done automatically: it becomes trivial to switch from one coding algorithm to another.

Encryption methods

Historically, encryption methods fall into two camps: substitution ciphers and transposition ciphers.

In a substitution cipher, each letter of the text is replaced by another letter to disguise it. If this is done in a systematic way, then anyone who knows the system can retrieve the original text by operating the substitution in reverse. For example, we could replace every letter by the letter three letters along on the alphabet, so 'a' becomes 'd', 'b' becomes 'e', 'y' becomes 'b', 'z' becomes 'c', and so on. The word 'computer' would be enciphered as 'frpsxwhu'.

This rather simplistic method can be generalised so that each letter is shifted by a different amount, and the amount by which it is shifted is given as a key. For example, if the key is 'dog', then the first letter of the text will be shifted by four letters, the second letter by 15 letters, the third letter by seven letters, and the fourth letter by four letters again (Fig 5).

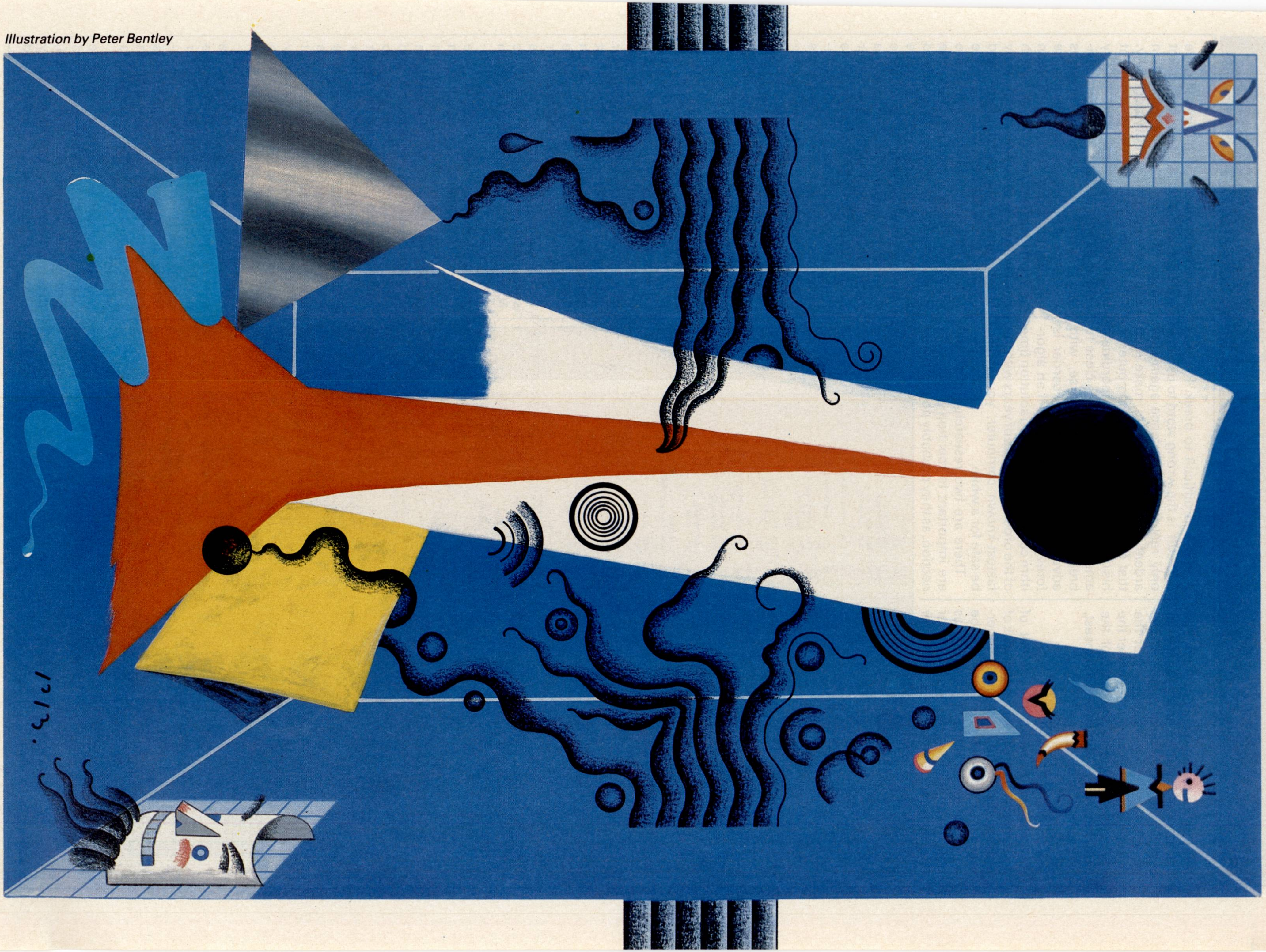
The key is laid along the original text to produce the ciphered text. Each letter of the original text is shifted by the appropriate amount to produce the ciphered text. The reverse process will reproduce the original text but only if you know the key, otherwise rubbish is produced. The longer the key that is employed, the more difficult it is to crack the code. If the key is longer than the text itself there will be no possible repetition, making the task almost impossible.

This is the basis of the 'one-time pad' used so successfully during the second world war. The key to be used is a page of text from a book. The person who is decoding the text merely has to know from which letter of the book to begin his decipherment (naturally this was a closely-guarded secret!).

A further stage in substitution ciphers is not to code single letters but combinations of letters, digrams or even trigrams. This is equivalent to using an alphabet of 26 × 26 letters, with each possible digram combination being considered as a different letter.

The feature of substitution ciphers is that they preserve the order of the original text, which can be a great help to anyone wanting to break the code. Transposition ciphers, on the other hand, reorder the letters in a systematic

Illustration by Peter Bentley



fashion but do not disguise them. The key to the cipher is a word or phrase not containing any repeating letters. The purpose of the key is to number the columns; column one being under the key letter closest to the start of the alphabet, column two the next closest, and so on (Fig 6).

Cipher research

As previously stated, the advent of computers has greatly eased the task of anyone wishing to break an encipher-ing code. You will therefore not be surprised to learn that much effort has been given to devising algorithms for encipherment that even a computer would find difficult to break. Perhaps 'difficult' is the wrong word to use: the only real form of defence against an ardent code-breaker is to make sure that even with the fastest computer at his disposal, it would take an inordinate amount of time to even come close to breaking the code. Of course, with advancing technology this barrier is forever being crossed, but if an algorithm can generate a mean solution time of the order of millions of years with the fastest-known computer, you should be safe for a while.

There are two research efforts that are important to mention in this connection, as they probably point the way to the methods and standards that we will all be adopting in the not too distant future. They are the Data Encryption Standard and Public Key Cryptography.

In January 1977 the US government adopted a product cipher developed by IBM as its official standard for unclassified information. This is now known as the Data Encryption Standard. The algorithm is a mixture of substitution and transposition ciphers in series with one another. By including a sufficiently large number of substitutions and transposition, the output can be made to bear little functional resemblance to the input. This is important, as anyone in possession of a piece of ciphered text, even a large piece, should not be able to make educated guesses as to the form of the input (for example, the occurrence of spaces within the text or the recurrence of certain words such as 'the', 'and', and so on). This is particularly a problem if the source of the text is known to be, say, a financial transaction. The would-be spy would expect to see certain words or phrases repeating themselves often — million, dollar, Bank of England.

Controversy

The Data Encryption Standard has become widely adopted in the US. Most chip manufacturers now sell chips dedicated to implementing the algorithm, and they are becoming cheaper all the time. When the standard was first published it was the subject of much controversy in academic circles. The original IBM implementation called for the use of a 128-bit key, but this was subsequently reduced to 56 bits by the National Bureau of Standards in Washington. There was also an incident that led some observers to the conclusion that publication of research into stronger versions of the algorithm was being stifled. The net effect of a short key, secret design principles and other factors has led some critics to believe that the US Government might not be unhappy with a standard cipher just strong enough to keep everyone except itself from breaking it. This is a significant charge when you realise that in the near future, telephones may contain micros capable of digitising and encrypting speech, and mail may be sent electronically from home terminal to home terminal. If unbreakable encryption ciphers were used in these applications, it would be impossible for governments to tap phones surreptitiously and read electronic mail, this being an activity that many modern governments feel that they cannot do without.

If two people wish to communicate using the Data Encryption Standard prior to the communication of any data, they must previously decide on the key that will be used for coding and

```
  20 REM cipher : translates plain
  30 REM text to cipher text using
  40 REM substitution method
  50
  60
  70 PROCinit
  80 PROCdisplay
 120 $keybuff% = key$
 130 ?keylen% = LEN(key$)
 150 inchan% = OPENIN(infile$)
 160 outchan% = OPENOUT(outfile$)
 170
 175 PRINT TAB(0,15)"PROCESSING"
 190 REPEAT
 200   PROCinbuff
 210   CALL code%
 220   PROCoutbuff
 230   UNTIL eof% = 1
 240 CLOSE£ inchan%
 245 PRINT TAB(0,15) blank$
 250 CLOSE£ outchan%
 260 PRINT TAB(0,15)"DONE!"
 270 END
 280
 290
 300 DEF PROCinit
 310 currentchar% = &70
 320 latestkey% = &71
 330 offset% = &72
 340 numchar% = &73
 350 keylen% = &74
 360 mode% = &75
 370 ?latestkey% = &FF
 380 top% = &21
 390 bot% = &7E
 400 base% = top%
 410 range% = bot% - top%
 420 bufflen% = &FE
 430 keybufflen% = &20
 440 codelen% = &100
 450 DIM incb% &0F, outcb% &0F,
      filebuff% bufflen%,
      keybuff% keybufflen%,
      code% codelen%
 460 incb%!9 = 0
 470 outcb%!9 = 0
 480 eof% = 0
 490 opt% = 2
 500 blank$ = STRING$(40," ")
 510 OSGBPB = &FFD1
 520 PROCassemble
 530 ENDPROC
 600
 610
 620 DEF PROCinbuff
 630 LOCAL status%
 640 A% = &03
 650 X% = incb% MOD &100
 660 Y% = incb% DIV &100
 670 ?incb% = inchan%
 680 incb%!1 = filebuff%
 690 incb%!5 = bufflen%
 700 status% = USR OSGBPB
 710 eof% = (status% AND &01000000)
      DIV&1000000
 720 ?numchar% = bufflen% - incb%!5
 730 ENDPROC
 740
 750
 760
 770 DEF PROCoutbuff
 780 A% = &01
 790 X% = outcb% MOD &100
 800 Y% = outcb% DIV &100
 810 ?outcb% = outchan%
 820 outcb%!1 = filebuff%
 830 outcb%!5 = ?numchar%
 840 CALL OSGBPB
 850 ENDPROC
 860
 870
 880
 890 DEF PROCassemble
 900 FOR mc% = 0 TO opt% STEP opt%
 910   P% = code%
 920   [OPT mc%
 930   LDX £&0
 940   .more
 950   LDA filebuff%,X
 960   JSR offset
 970   STA filebuff%,X
 980   INX
 990   CPX numchar%
1000   BNE more
1010   RTS
1020   :
1030   :
1040   :
1050   .offset
1060   SEC
1070   SBC £base%
1080   CMP £range%
1090   BEQ cont
1100   BCS rangeok
1110   .cont
1120   STA currentchar%
1130   :
1140   LDY latestkey%
1150   INY
1160   STY latestkey%
1170   CPY keylen%
1180   BCC keyok
1190   LDY £&FF
1200   STY latestkey%
1210   INY
1220   .keyok
1230   LDA keybuff%,Y
1240   SEC
1250   SBC £base%
1260   STA offset%
1270   :
1280   LDA mode%
1290   BPL code
1300   :
1310   .decode
1320   LDA currentchar%
1330   CLC
1340   ADC £range%
1350   SEC
1360   SBC offset%
1370   JMP coded
1380   :
1390   :
1400   .code
1410   LDA currentchar%
1420   CLC
1430   ADC offset%
1440   :
1450   .coded
1460   CMP £range%
1470   BCC rangeok
1480   SEC
1490   SBC £range%
1500   :
1510   .rangeok
1520   CLC
1530   ADC £base%
1540   :
1550   RTS
1560   ]
1570
1580   NEXT mc%
1590 ENDPROC
1600
1610
1620 DEF PROCdisplay
1630 LOCAL tab%,in%,out%,inmode%,
      mode$,k%
1640 tab% = 1
1650 VDU 22,7
1660 PRINT TAB(6,0)"Cipher program"
1670 PRINT TAB(tab%,5)
      "Input file name  : ";
1680 INPUT infile$
1690 PRINT TAB(tab%,7)
      "Output file name : ";
1700 INPUT outfile$
1710 PRINT TAB(tab%,9)
      "Key (max 15)     : ";
1720 key$ = ""
1730 out% = FALSE
1740 k% = 0
1750 REPEAT
1760   in% = GET
1770   IF in% >= &20 AND in% <= &7E
         THEN key$ = key$ + CHR$(in%):
         PRINT CHR$(in%);:
         k%=k%+1
1780   IF in% = &0D THEN out% = TRUE
1790   IF in% = &7F
         THEN IF LEN(key$) <> 0
         THEN PRINT CHR$(in%);:
         key$ = LEFT$(key$,LEN(key$)-1)
1800   UNTIL out% OR k% = 15
1810 REPEAT
1820   PRINT TAB(tab%,11) blank$
1830   PRINT TAB(tab%,11)
         "Mode (C or D)    : ";
1840   inmode% = (GET AND &DF)
1850   mode$ = CHR$(inmode%)
1860   UNTIL mode$ = "C" OR mode$ = "D"
1870 IF mode$ = "C"
     THEN ?mode% = 1:PRINT"Code"
1880 IF mode$ = "D"
     THEN ?mode% = -1:PRINT"Decode"
1890 ENDPROC
```

Fig 1 The cipher program

```
9YT  U`fOYk  af]MWF^  f[cb  Lb\`XS UW IVRa[[ [\^ Tc\ZJSeb a] W

M]eV iaOSL eWW jkIgmZhcZNT_ \Wk^VX  pZhV  G ZXVa elfW`bVX YK^p

EWW  i[Ziee  cT  ZMJ  V]U`fOYk^Y\Z NX dcai[K  ilZbU  ZMJ  fbWi

i\di]]SJ KN]T `XcL" MYY ^XTLcP_  Y[N]gd  Vg VWT^_f`dN haV iaKW

K`a f_[ Pbifh TOQJ _P_\" [\^ `ibVZY  WX^\  dHa^z hVK PJj ca Y[

\g^U  U\J YMV \a[[ q YgTcRK TW UTUfZL" Be  hVKS  IZbbcW`g  mYY

[KXXRVW vFYc\VYaYNSXn  i__Sgm  e\S  VWTTTej_U[  hW hVK KN]T [j

[_Y\fhSJp <YT` k^L cnedcZ KN]T ZXi  IY^_  gO\JI e^ f_[ JikcY\Z

KN]X`^ i`gmVa bNJ RVbeX]L s=`bSe NX UXegbHm^U U\J  YMV _df]YUf

VbRYp
```

Fig 2 An experimental message

subsequently decoding that data. This involves the setting up of a separate communications channel (letter, word of mouth, courier) for the transmission of the key. This has significant disadvantages. The security of the key is of the utmost importance, and it is not a good idea to have to communicate this every time you wish to send encrypted data. The more times you distribute the keys, the greater the likelihood that their security will be compromised. It also makes it very inconvenient to communicate with people with whom you have never previously communicated.

Before any transmission of data can take place, you must go through the tedious and time-consuming process of sending the keys for the decipherment of the data you want to send. It would be much better if the communication channel itself could somehow be utilised to send the decoding keys in a secure manner. This is the basis of Public Key Cryptography.

Up to now I have tacitly assumed that the same key is used for both coding and decoding the data. With a substitution cipher, instead of adding a particular offset to a character of data in order to encode it, you would subtract the offset to decode it. Possession of this single key would therefore enable anyone to decode the data or to encode his own data with the same key. Public key encryption uses two keys, one for encoding and a separate one for decoding the data. The encoding key can be made public for anyone to use, but as long as the decoding key was kept secret, no-one would be able to decode any data that was intercepted. For example, if user A wishes to communicate with user B he sends B a message, encoding it using B's public key. When B receives the message he decodes it using his own secret decoding key, and may send a reply using A's public key. At no stage in the exchange does B have to communicate his decoding key to A.

Letter	%freq	Letter	%freq
A	7.16	B	1.22
C	3.90	D	4.26
E	12.99	F	2.50
G	1.94	H	3.99
I	8.50	J	0.05
K	0.20	L	3.55
M	2.62	N	6.74
O	7.29	P	2.09
Q	0.14	R	6.51
S	7.73	T	9.93
U	2.63	V	1.12
W	1.18	X	0.30
Y	1.35	Z	0.01

Fig 3 Typical frequency distribution for standard English text letters

The fundamental idea is very simple; the difficult part comes in trying to find an algorithm that would meet the requirements of the situation. We require a decoding algorithm which, when applied to coded data, reproduces the original data, but at the same time a decoding key which is not derivable from the encoding key.

One solution to this problem that has been offered involves the use of very large prime numbers. If two prime numbers are multiplied, the result of this multiplication will have only one pair of factors — the two prime numbers. Of course if you know one factor you can calculate the other, but if one of the factors is sufficiently well disguised, it can be used as the basis for an encoding key that can be made publicly available. Given a large number, it is exceedingly difficult to discover the identity of the factor pair — factoring a 200-digit number requires approximately four billion years of computer time. It is likely that Public Key Cryptography, probably based on an algorithm not unlike the one published here, will play an increasingly important role in the data communications marketplace of the future.

The cipher program

The cipher program (Fig 1) will encode or decode the contents of a file using the substitution method with a user-supplied key. The result of the encipherment is stored using the user-supplied filename. The program begins by prompting the user for the input filename, the output filename, the key to be used and the mode — encode or decode. It then displays the message 'Processing' while the processing of the file is executed. When the output file has been saved to the current filing system, the message 'Done' is displayed and the program ends.

The program's main area is from lines 70 to 270. The procedure Init initialises all required variables and arrays; it also calls a procedure that assembles the machine code routine Code% which will be used to process the characters of the input file. The code for the procedure is between lines 300 and 530. The procedure Display prompts the user for all the required input, and is located between lines 1620 and 1890. Lines 130-160 initialise the variable key length to the length of the ciphering key, and open an input channel for read and an output channel for write.

The main processing is in procedures called in lines 175-230. This consists of a loop which will be executed until the end of the input file is reached. Three procedures are invoked — Inbuff, Code% and Outbuff.

Inbuff (lines 620-730) uses the operating system call OSGPBP (operating system get byte put byte) to transfer a number of bytes from the input file into a buffer. If the call detects the end-of-file because it has read the last byte of the file, the variable eof% is set.

> *'. . . a strategy for cracking the code can be established that will succeed — eventually.'*

Code% is a machine code routine that will process the contents of the buffer. The assembler code for this routine is between lines 930 and 1550. The routine looks at every character in the buffer and decides whether it should be substituted for another character, and if so, which one. Lines 950 to 1000 get each character from the buffer and call the subroutine Offset. The result of the Offset routine is returned in the accumulator, which is then placed in the buffer at the same place from which it was retrieved. The subroutine Offset firstly has to decide whether the character is within the range specified by the variables top% and bot%. If the character is outside this range it is left unchanged, otherwise it is placed in the variable currentchar% for safekeeping.

We now have to discover the value of the latest character in the user-supplied cipher key. The key itself is held in a separate buffer — keybuff%. Latestkey% is a pointer into this buffer, being the character number of the latest ciphering character within the buffer. Lines 1140-1210 make sure that this value stays within the range 0-keylen%-1. Having decided the value of latestkey%, the actual character is loaded from keybuff% into the accumulator.

The next decision is to ascertain which mode the program is in — code or decode. This information is supplied by

the user and is held as the contents of the variable mode%. If the value of mode% is 1 the value of the cipher offset is added to the contents of currentchar%, otherwise it is subtracted. The accumulator at this stage contains the character that is to be placed back in the buffer, and the subroutine Offset exits back to line 970 for this storage to take place. The result of the subroutine Code% is that the contents of a particular location in the input buffer have been replaced by the appropriately ciphered or deciphered output character.

When the whole buffer has been processed in this way, the contents of the buffer are written to the output file using the procedure Outbuff, which operates in an analogous way to the procedure Inbuff. When the whole of the input file has been processed, the channels are closed and the concluding message is displayed.

The result of applying this program to the earlier paragraph beginning 'The cipher program' and ending with 'program ends' with the key 'computerworld' is shown in Fig 2.

Given an enciphered text such as this, how do you go about attempting to restore the original? The first thing to establish is what kind of encryption algorithm has been used. A transposition algorithm moves the letters around but does not change any of them. On the other hand, a substitution algorithm preserves the original order of the data but changes the text in a systematic way. If a transposition algorithm has been used, a count of the frequency of the letters in the text will reveal the expected distribution for standard English.

With a substitution algorithm we would expect this distribution to be radically altered. For example, in standard English text the letter 'E' takes up about 13 per cent of the characters. The second most popular letter is 'T' at approximately 10 per cent. The typical frequency distribution of letters for standard English text is shown in Fig 3.

A table of percentage frequency distributions such as the one in Fig 3 can be produced for any file using the Letfreq program, also published here (Fig 4). The main part of the program is at lines 70-110 where three procedures are called. The procedure Init initialises all variables and arrays, and in addition calls a procedure to assemble a machine code routine to process the file. The procedure Compute performs the actual processing of the contents of the file, and the procedure Display prints the results to the screen. Init begins at line 140, Compute begins at line 460, Display begins at line 600, and the code for the assembler routine begins at line 990.

The main procedure of the program, Compute, itself calls two routines, Inbuff and Code%, in a loop until the end if the file is reached. The program uses a buffer to store the partial contents of the file in 254-byte chunks. The procedure Inbuff performs this function using the operating system command OSGBPB, and the contents of this buffer are analysed by the machine code routine Code%. The procedure Inbuff begins at line 850. The routine Code% analyses the contents of the buffer, looking for alphabetic characters. When it finds a character within the specified range, it updates the location associated with that letter's occurrence by adding 1 to the previous contents. These locations are an array, letters%, that contains four bytes for each of the 26 letters. The contents of the array are initialised to zero in the procedure Init.

When the contents of the file have been processed in this way, these locations contain the absolute frequency of the alphabetic characters found in the file. Each time a valid letter is found a counter is incremented, and at the end of the program run, the value of this counter is the total number of characters that were found. This value is used to compute the percentage frequencies. The procedure Display uses this information to format the results in tabular form.

Conclusion

By first establishing what kind of algorithm has been employed and then making successive guesses at the length of the enciphering key, a strategy for cracking the code can be established that will succeed — eventually. If you are attempting to crack such a code there are three basic requirements — a lot of text, a large computer, and a lot of spare time. Good Luck! END

```
  20 REM letterfreq: given a file
  30 REM computes the frequency of
  40 REM letters within the file
  50
  60
  70 MODE3
  80 PROCinit
  90 PROCcompute(FNinput)
 100 PROCdisplay
 110 END
 120
 130
 140 DEF PROCinit
 150 @%=0
 160 CLS
 170 bufflen% = &FE
 180 DIM cb% 15, filebuff% bufflen%,
         letters% 104, code% &100
 190 FOR i = 0 TO 104
 200   letters%?i = 0
 210   NEXT i
 220 cb%!9 = 0
 230 eof% = 0
 240 status% = 0
 250 base% = &41
 260 mask% = &DF
 270 top% = &1A
 280 opt% = 2
 290 letterpos% = &70
 300 !letterpos% = letters%
 310 numchar% = &72
 320 count% = &74
 330 !count% = &00
 340 OSGBPB = &FFD1
 350 PROCassemble
 360
 370 ENDPROC
 380
 390
 400 DEF FNinput
 410 PRINT"Enter file name  ";
 420 INPUT name$
 430 = name$
 440
 450
 460 DEF PROCcompute(filename$)
 470 PRINT"PROCESSING"
 480 chan% = OPENIN(filename$)
 500 REPEAT
 510   PROCinbuff
 520   PRINT TAB(0,5)"Character count : "
             !count%
 530   CALL code%
 540   UNTIL eof% = 1
 560 CLOSE#chan%
 570 ENDPROC
 580
 590
 600 DEF PROCdisplay
 610 CLS
 620 PRINT TAB(0,0)"Let"TAB(6,0)"freq"
           TAB(15,0)"%freq"TAB(28,0)"Let"
           TAB(34,0)"freq"TAB(43,0)"%freq"
 630 FOR i = 0 TO 12
 640   PRINT TAB(0,i+2)CHR$(base%+2*i)
 650   num% = letters%!(8*i)
 660   @% = &20209
 670   PRINT TAB(4,i+2)num%
 680   @% = &20209
 690   PRINT TAB(10,i+2)
             INT((num%*100+.5)*100/!count%)/100
 700   PRINT TAB(28,i+2)CHR$(base%+1+(2*i))
 710   num% = letters%!(4+(8*i))
 720   @% = &000906
 730   PRINT TAB(32,i+2)num%
 740   @% = &20205
 750   PRINT TAB(42,i+2)
             INT((num%*100+.5)*100/!count%)/100
 760   NEXT i
 770
 780 @% = &090A
 790
 800 PRINTTAB(0,20)
         "Total number of characters : "
         !count%
 810 ENDPROC
 820
 830
 840
 850 DEF PROCinbuff
 860 LOCAL status%
 870 A% = &03
 880 X% = cb% MOD &100
 890 Y% = cb% DIV &100
 900 ?cb% = chan%
 910 cb%!1 = filebuff%
 920 cb%!5 = bufflen%
 930 status% = USR OSGBPB
 940 eof% = (status% AND &01000000)
         DIV&1000000
 950 ?numchar% = bufflen% - cb%!5
 960 ENDPROC
 970
 980
 990 DEF PROCassemble
1000 FOR pass% = 0 TO opt% STEP opt%
1010   P% = code%
1020   [OPT pass%
1030   LDX £&0
1040   .morebuff
1050   LDA filebuff%,X
1060   SEC
1070   SBC £base%
1080   AND £mask%
1090   CMP £top%
1100   BCS ok
1110   ASL A
1120   ASL A
1130   TAY
1140   CLC
1150   LDA count%
1160   ADC £&01
1170   STA count%
1180   LDA count%+1
1190   ADC £&00
1200   STA count%+1
1210   CLC
1220   LDA (letterpos%),Y
1230   ADC £&01
1240   STA (letterpos%),Y
1250   BCC ok
1260   INY
1270   LDA (letterpos%),Y
1280   ADC £&00
1290   STA (letterpos%),Y
1300   .ok
1310   INX
1320   CPX numchar%
1330   BNE morebuff
1340   RTS
1350   ]
1360   NEXT pass%
1370 ENDPROC
```

Fig 4 The Letfreq program

```
Original text: THIS IS SOME TEXT TO BE DECODED
Key          : DOGD OG DOGD OGDO GD OG DOGDOGD
Ciphered text: XWQW XA WDUI IMBI BS QM HTKSSMH
```

Fig 5 The key is laid along the original text to produce the ciphered text

```
Key  : K E Y R I N G
Order: 4 1 7 6 3 5 2
       -------------
       t e l l m e e
       v e r y t h i
       n g y o u k n
       o w a b o u t
Original text  :  tellmeeverythingyouknowabout
Ciphered text  :  eegweintmtuotvnoehkulyobeegw
```

Fig 6 A transposition cipher where the key numbers the columns

SCREENTEST

Excel

Will Microsoft's Mac spreadsheet package Excel be a worthy challenger to Lotus Jazz? Mike Liardet weighs up the merits of a package which makes full use of the Mac's unique style.

Excel can be viewed as Microsoft's answer to Jazz. It offers sophisticsted spreadsheeting facilities, graphics, and the spreadsheet style of database pioneered by Lotus 1-2-3.

Excel is designed to run on the Apple Macintosh. Not surprisingly, with all those facilities, it requires the so-called 'Fat Mac' with 512k of RAM, as well as a second disk drive. Except for the most trivial usage, a printer would be essential, with Apple's own ImageWriter being the obvious choice as it provides excellent copy of the charts and graphics generated by Excel.

The review software was a Beta-test version with a photocopied draft of the manual. It is worth emphasising that this is a very advanced Beta-test version, with very few holes and not too many bugs encountered during the review period. Unless Microsoft spends nine months gestating over a box to put it all in, Excel ought to be released very shortly.

As soon as Excel is up and running, the user is faced with the display shown in Fig 1. This is a combination of a fairly standard spreadsheet and a standard Mac applications environment.

As with most spreadsheet software, Excel simulates a window onto a small portion of a very large spreadsheet. In the initial display, six columns labelled A to F can be seen. Excel has many more columns available, labelled from G to Z then from AA to AZ, and so on, up to IV, with 256 columns in all. The rows are simply numbered, and the first 19 of 16,384 can be seen in the initial display.

Taking full advantage of the Mac's superb graphics capabilities, the rows and columns are faintly delineated on the screen so it's easy to locate the row/column identification for any given cell. One cell is emphasised, and is given the current 'action point'. Anything typed at the keyboard, for example a number or fragment of text, is assumed to be intended for the current cell and is entered into it as it is typed.

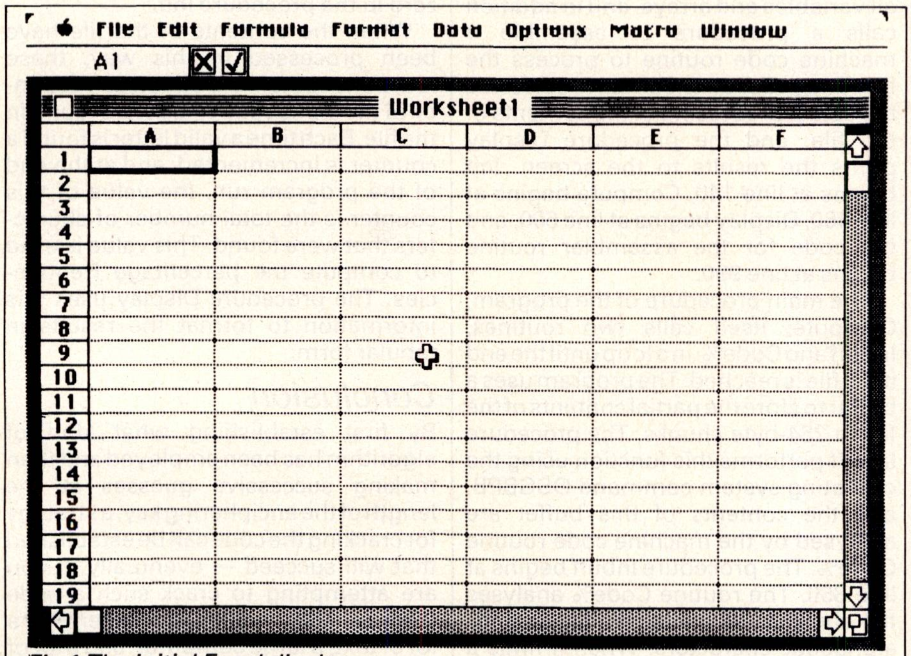


Fig 1 The initial Excel display

The current action point can easily be changed using the mouse. So much has been written on the Mac's mouse (*PCW*, March 1984) that I will be very brief here. The mouse can be used for virtually any operation you might want to perform in Excel. The cross in the middle of the screen indicates the current mouse position. When it is at the point you want on the spreadsheet, just click the mouse button and that cell will be the new action point.

Most of the display is devoted to the spreadsheeet, but there is a surrounding border with arrows and cryptic symbols, as well as a couple of additional lines at the top of the screen.

These extra facilities come 'free' with the Mac, and now that a number of software developers have mastered them, there is at last a fair amount of Mac software that makes use of them. This standardisation should be of great value to the user as, having learned to use one package, says Excel, he will be able to drive all sorts of other packages that work in a similar way.

Initially Excel fills the entire screen with the single spreadsheet display, but there are facilities for shrinking or moving the window onto the spreadsheet. There is no reason to do this until additional windows have been created and are fighting for space on the screen. Excel allows multiple spreadsheets and graphics windows, and these shrink-and-move facilities enable several sheets to be displayed side by side.

The top line of the display contains the main menu options which work in the normal Mac manner. In the spirit of standardisation, many other packages have similar-looking master menus. Nearly all have the Apple logo option, File and Edit for example, but within each menu the sub-options usually differ slightly, being tailored to the

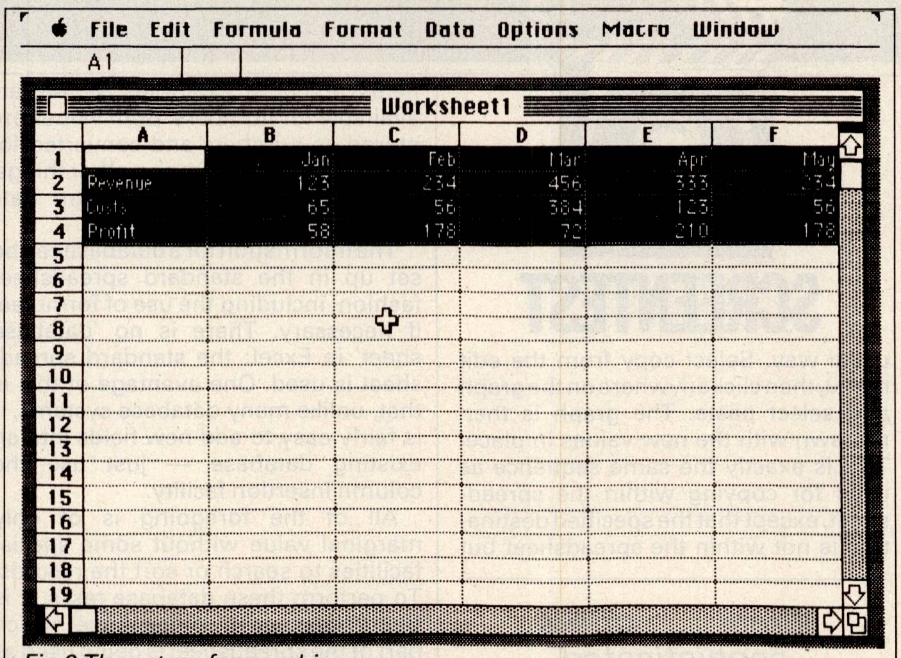


Fig 2 The set-up for graphing

particular application.

Spreadsheeting

The basic operations on all spreadsheets involve entering numbers, text or formulae into the cells. It is surprising how little the keyboard is needed and how much of spreadsheeting involves pointing and menu operations, both of which can be performed with the mouse.

To verify that Excel can work like an ordinary spreadsheet, make A1 the active cell, and type a number followed by 'enter'. The number is displayed at A1, and the active cell drops down to A2. Enter another number. Then in cell A3, enter a formula. Formulae are preceded by an = sign so enter, say, = A1 + A2. Instantly the calculation is made and the result is displayed in A3. Move back to A1 and change the number there. Instant recalculation.

Sounds familiar? There are alternatives which reduce the amount of keyboard work which are most apparent when entering a formula. After pressing =, any cell reference can be entered by pointing in the right place with the mouse. None of the functions need be typed at the keyboard — they can be selected straight from a menu, and so on. While the formula is being set up the text appears on the line immediately below the menu line, alongside a tick and a cross. Select the tick with the mouse as an alternative to 'enter' or select the cross to abandon, and restore the original cell contents. In many cases it can be much faster working with the mouse, but keyboard addicts can work in the conventional way.

When text is too wide for the column width, it cannot be fully displayed unless there is nothing in the adjacent cell. By adjusting the column width, the whole text can be seen. Excel allows column widths to be adjusted in a very simple and direct way. The vertical line on the right of the relevant column heading can be dragged by the mouse to wherever you would like it to be. The display is then redrawn, with the entire column width changed as indicated.

Excel contains a full set of orthodox spreadsheeting facilities, various numeric display formats, row/column deletion, and so on, but wherever possible these commands are excecuted by pointing with the mouse rather than typing command sequences. For example, to copy part of the spreadsheet, first drag the mouse from top-left to the bottom-right of the area to be copied. It is then displayed in reverse. Click on the edit option to reveal 10 sub-options below, then pull down the mouse to select the copy operation. The inverse area reverts to normal, except for an animated dotted line around it. Now drag the mouse over the destination area. Back to edit, select paste this time, and *voila*! Made a mistake? Go back to edit and select undo to restore everything as it was.

Graphs

Suppose that we wish to draw a graph of the simple spreadsheet model of Fig 2. Firstly, we drag the mouse over the area to be plotted; as usual this is displayed in inverse. Then we must create a second sheet to hold the graph. Excel can work with three different types of sheet: the spreadsheet; the chart sheet for holding graphs; and the macro sheet. To draw a graph it is necessary to create a chart sheet. This is done by pulling down the sub-options under file, then selecting 'new chart'. The spreadsheet is instantly overlaid with the chart, as shown in Fig 3.

The layout of the graph is completely planned by Excel, with scaling and the choice of cross-hatching all automatically set up. The horizontal axis annotation is taken from the top line of the spreadsheet, and the numeric values are plotted in the usual way. Excel also takes note of the row headings, but this is not evident in the bar chart.

It is very easy to change the style of the graph. Notice (at the top of Fig 3) that some of the menu options are different from those for the spreadsheet. The chart option offers a number of sub-options, one of which is to change the graph to any of six different styles: area, bar, column, line, pie and scatter.

Although Excel can handle an arbitrary number of sheets of all types, it makes sense for only one to be current at a time. In Fig 3, the chart sheet 'Chart 1' is current. If we now wish to make changes to the spreadsheet, it is necessary to make it the current one. This can be done by moving off the chart window and clicking anywhere on the spreadsheet. (In more complex situations than this, where there are a large number of sheets, it is easy to get lost.) Then the window menu option can be used. This option lists all

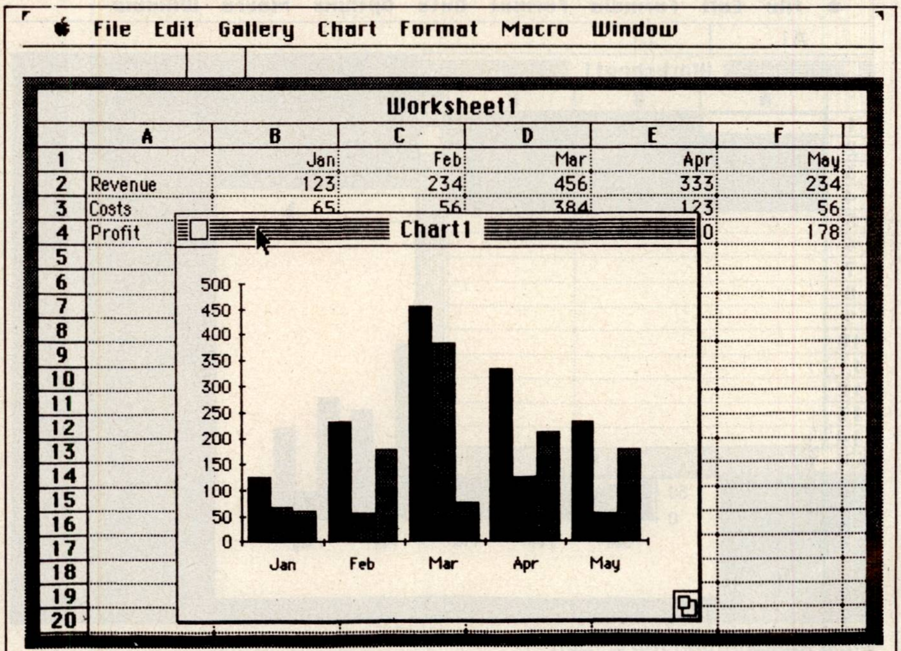


Fig 3 After the graph has been drawn

SCREENTEST

available sheets, and the required one can be quickly identified and selected.

When the spreadsheet is current it comes to the foreground, completely covering the chart. In spite of this the chart is still in full communication with the spreadsheet, and any changes made there will be instantly reflected in the graph. Spreadsheet and graph working together can be achieved by shrinking the spreadsheet window and repositioning the chart.

First move the mouse to the overlapping squares symbol, seen in the bottom right-hand corner of Fig 2. The size of the window on the spreadsheet can be adjusted by dragging the mouse to the position at which you would like this symbol. The display is then completely redrawn, and a part of the graph window becomes visible (Fig 4). This can then be pulled out from under the worksheet by moving the mouse to the title bar (see black arrow in Fig 4), and dragging that to a new location. The graph sheet can be shrunk in size too, if necessary. We can move the mouse backwards and forwards to make adjustments to either the graph or the spreadsheet at will. The graph is always in step with the spreadsheet.

Although Excel can automatically plan a chart, it also offers numerous manual overrides for annotating axes, titling, rescaling, and so on. It is also possible to arrange for more spreadsheet cells to be plotted in the same graph. This would not be relevant for the simple spreadsheet in Fig 2, where everything is included, but can be useful for more complex cases where it is necessary to select various rows or columns.

Excel allows the graph to be augmented. Mark out the required area in the spreadsheet to be plotted in the usual way. Select copy from the edit menu, then click anywhere on the graph and select paste. The graph is then redrawn with the new values in place. This is exactly the same sequence as used for copying within the spreadsheet, except that the specified destination is not within the spreadsheet but within a chart sheet. The same general copying procedure can be used between any of the Excel sheets.

'Excel . . . offers sophisticated spreadsheeting facilities, graphics, and the spreadsheet style of database pioneered by Lotus 1-2-3.'

Database

It is possible to build simple databases with Excel by considering each row of the spreadsheet as a record and each column as a field. For example, Fig 5 shows part of a database for expense claims. Each record (or row) is a particular expense claim, and the first column (or field) contains the date of the claim, followed by the type, amount and claimant. The date and amount fields are both examples of formats available for numbers. Both values are stored as numbers and converted for display purposes. Among other things, this enables Excel to perform date arithmetic.

The information for a database can be set up in the standard spreadsheet fashion, including the use of formulae, if necessary. There is no 'database sheet' in Excel: the standard spreadsheet is used. One avantage of this is that, unlike many database systems, it is fairly easy to add new fields into an existing database — just use the column insertion facility.

All of the foregoing is of only marginal value without some special facilities to search or sort the records. To perform these database tasks, it is first necessary to inform Excel which part of the spreadsheet is being used as a database. It is quite possible to use other areas of the spreadsheet for non-database activities, and so Excel needs to be told which area to work on. The database area must be marked out in the usual way, being displayed in inverse. Then the 'set database' sub-option of the 'data' menu option is used. Excel has the facility to name regions and use them subsequently in formulae, and the set database is a convenient way of giving the required region the name 'database'. Of course, 'database' is a name of special significance to the database commands.

When the database region has been specified, a criterion region must be set up on which the SEARCH command will operate. It is convenient for this to be at the top of the spreadsheet, and in line with this, it is recommended that you start the database a few lines down from there. The column headings/field names can be quickly copied to the top row, then the top row and the next one can be named as the criteria region by the 'set criteria' sub-option, similar to set database.

Having set up the criteria and database, records can be sought by filling in the required details immediately below the criterion names and using the find sub-option of data. If nothing is specified for a field name, then any record will do for that field. Each record matching the criteria is displayed in turn, and the down arrow, in the bottom-right of the window, can be used to flick on to the next. In the Beta-test version there were a few bugs, resulting in records frequently being missed.

It is possible to perform calculations on the database by using Excel's database statistical functions. Suppose the total expenses on salaries is required. Firstly, set the criteria to find all records where 'expense' is 'salary', then use the formula: DSUM (Database, 'Amount', Criteria) to perform the calculation. DSUM totals all 'amount'

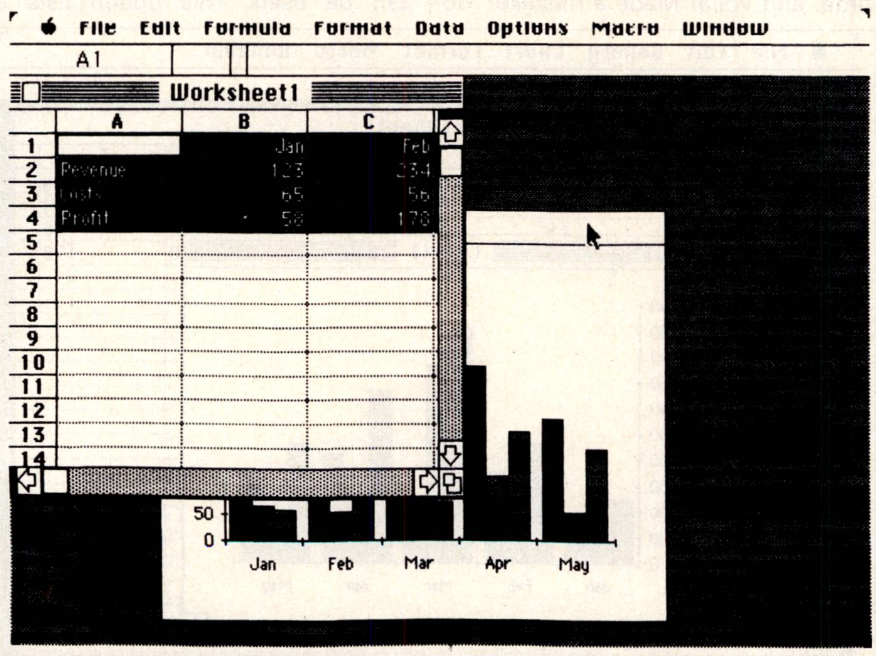


Fig 4 Redesigning the screen

values from records in database-matching criteria.

There are other functions like DSUM: DAVERAGE, DMAX and DMIN, and DCOUNT to count the number of records found; and DSTDEV and DVAR for standard deviation and variance. All the database function names commence with D, and differ from their non-D cousins in that the ordinary functions only work non-selectively and will indiscriminately apply to all values in a specified region.

The data menu option contains a sub-option to sort the database. It is possible to sort either the rows or columns in ascending or descending order. Up to three fields can be specified. If on the first field there are several records with the same value, then they are ordered according to the values in the second specified field. If any of these match as well, then the third field is used to discriminate.

Advanced facilities

Excel has some very advanced facilities which may appeal to the programmer. It is possible to perform array calculations and also use a macro facility. Conventional spreadsheet users can ignore these extras, which never intrude on the normal operation of Excel, but if they make the effort to learn them they will be able to take a number of shortcuts in their subsequent spreadsheeting activities.

	A
1	=HLINE(-3)
2	=SELECT("RC:RC[11]")
3	=HLINE(-7)
4	=FORMULA("JAN")
5	=SELECT(,"R[1]C")
6	=FORMULA("FEB")
7	=SELECT(,"R[1]C")
8	=FORMULA("MAR")
9	=SELECT(,"R[1]C")
10	=FORMULA("APR")
11	=SELECT(,"R[1]C")
12	=FORMULA("MAY")
13	=SELECT(,"R[1]C")
14	=FORMULA("JUN")
15	=SELECT(,"R[1]C")
16	=FORMULA("JUL")
17	=SELECT(,"R[1]C")
18	=FORMULA("AUG")
19	=SELECT(,"R[1]C")
20	=FORMULA("SEP")
21	=SELECT(,"R[1]C")
22	=FORMULA("OCT")
23	=SELECT(,"R[1]C")
24	=FORMULA("NOV")
25	=SELECT(,"R[1]C")
26	=FORMULA("DEC")
27	=SELECT(,"R[1]C")
28	=RETURN()

Fig 6 A macro program

Expenses

	A	B	C	D	E	F
10	Date	Expense	Amount	Vendor		
11	1/1/84	overhead	$1,000	A.B. Properties		
12	1/5/84	overhead	$566	Ace Power & Light		
13	1/5/84	overhead	$600	Wheelin's Gas Co.		
14	1/5/84	overhead	$200	Ralph J Cook Garbage		
15	1/5/84	overhead	$440	City of Franklin		
16	1/6/84	inventory	$16,000	SW Wholesale		
17	1/5/84	salary	$1,000	Mary Fuller		
18	1/5/84	salary	$1,270	Carol Stansen		
19	1/5/84	salary	$945	Jim Parsons		
20	1/5/84	salary	$700	Karen Bush		
21	1/5/84	salary	$1,000	James Gregory		
22	1/5/84	salary	$1,160	Lisa La Flamme		
23	1/5/84	salary	$2,000	Andy Lubert		
24	1/15/84	overhead	$5,000	AR Office		
25	1/15/84	salary	$1,000	Mary Fuller		
26	1/15/84	salary	$1,270	Carol Stansen		
27	1/15/84	salary	$945	Jim Parsons		
28	1/15/84	salary	$700	Karen Bush		
29	1/15/84	salary	$1,000	James Gregory		

Fig 5 An example of a database

The array facility can be demonstrated by building a formula, for example:
SUM (B2:x2 ⋆ B3:x3)

Other spreadsheet systems would fail to recognise this, as it indicates a requirement to simultaneously multiply several pairs of values. In other systems we would be forced to use a less concise:
B2⋆B3 + C2⋆C3 + D2⋆D3 + E2⋆E3 . . . + X2⋆X3
or, more likely, allocate a row, say row 4, for the individual products and then SUM(B4:X4).

With Excel, it is also possible to include constant arrays in a formula, for example:
SUM(1,2,3) ⋆ B3:D3)

There are a number of other sophistications, such as a transpose function, which should put a gleam in the eye of the APL programmers.

The third type of sheet provided by Excel is the macro sheet. This sheet looks very like an ordinary spreadsheet and can be used in the usual way, but it is normally used to hold macro programs. A macro program is a sequence of special formulae which can be executed in order to control the overall operation of all or part of an Excel session. It is useful to imagine the macro facility as a type of automatic keyboard, where the commands and operations are read from the macro sheet instead of from the mouse and keyboard.

The simplest way to use the macro facility is to first initialise a macro sheet, then select 'start recorder' from the macro menu. Every spreadsheet operation made subsequently is then automatically written into the macro sheet, errors and all. Window sizing and moving are ignored, but moving the active cell cursor, and entering data and formulae are all entered on the macro sheet. The recorder can be switched off by the 'stop recorder' option on the macro menu.

A simple macro is shown in Fig 6. It is a recording of all the operations needed to enter the 12 month names across a row. It can be run at any time by using the run macro option, and will automatically enter the month names without any further intervention at the keyboard.

The macro facility can do considerably more sophisticated tasks than setting up month headings. In this example the only macro functions used are HLINE and SELECT, but there are many others.

For complicated situations it is not usually convenient to use the record method of building macros, and the macro sheet can be worked on directly, just like any other Excel spreadsheet.

Conclusion

With the exception of its multiple spreadsheets, the scope of Excel is almost identical to that of Lotus 1-2-3 (which is, of course, not available on the Macintosh). With all the extra Mac features grafted into Excel, it is even easier to use than 1-2-3 and is a delight to work with.

Although Lotus has not released a Mac version of its spreadsheet package 1-2-3, it has released Jazz, a Mac integrated package equivalent to Symphony. Symphony is supposedly a more sophisticated product than 1-2-3, and correspondingly it must be said that Jazz does offer some features missing from Excel, for example word processing and communications. But it is possible that Microsft has made an astute move with its blend of Excel features. Although Symphony offers more than 1-2-3, it has never outsold it.

Users seem to prefer the simplicity of a spreadsheet environment without the complication of the other facilities. Microsoft will obviously be hoping that Mac users feel the same when weighing up Jazz and Excel. END

EDUCATION

Languages

Basic is the most common language used in schools, but does it fulfil all the criteria for a good educational programming language? R J Elliot presents the case for Comal as a better performer in the school stakes.

The history of educational computing has a close link with the history of the micro, as one has followed closely — and sometimes blindly — in the footsteps of the other. As the micro has become more technically sophisticated and the accompanying software more varied and useful, school computing has similarly evolved, and at last curricula are appearing that reflect the role computing plays in the real world. Today micros, running good applications packages and supporting a number of programming languages, are available at prices that schools can afford.

However, while schools seem to have taken aboard the better applications, programming remains in the doldrums. In the early eighties, when micros were first introduced into the curriculum, there were precious few applications packages available and even fewer programming languages. Invariably the language supplied with the machine was Basic, and as there was a chronic shortage of computing expertise among staff, crash courses in programming were undertaken and many computer studies classes degenerated into short courses in Basic.

Why teach programming?

Before I'm condemned as yet another Basic basher, let me examine why programming needs to be taught at all.

Firstly, programming can be a vocational requirement. Students who plan careers in the computing field should be introduced to proper programming techniques: that is, techniques consistent with those used in commercial programming environments.

Secondly, it can give an insight into the workings and logic of a computer. Anyone who has ever written a computer program will realise certain fundamental aspects of the workings of the machine that cannot be gained by using any number of applications packages. In particular, writing even one program (and especially your first) belies the commonly-held notion of computer infallibility.

Lastly, programming will develop students' analytical and problem-solving abilities. Much school mathematics is based on this objective.

The more a programming language satisfies the above criteria the better, so how does Basic shape up? Basic does not satisfy the vocational requirement. Although it is used as the main programming language in a few installations, it is a non-standard language in many respects. In particular it is almost impossible to apply normal problem-solving techniques to this language, and experience in Basic programming is not considered a good basis for progression to more standard high-level languages. In the preface to *Pascal from Basic*, Peter Brown writes: 'The task of the Basic programmer (in learning Pascal) is probably harder than that of the novice, because Basic is actually the maverick among programming languages. It is harder to learn concepts and then to relearn them in a new way, than to start from scratch.'

On the second point, Basic scores highly. Indeed, minimal Basic has similarities with assembly language and provides a better insight into the workings of the machine than most other high-level languages.

As far as Basic's problem-solving properties are concerned, it performs poorly. The unstructured, almost algebraic notation conceals the nature of the underlying problem.

One out of three is not very good, so what of the competition? Most serious micros can run Cobol and Pascal, and although they achieve better marks than Basic (especially the vocational aspect of Cobol and the problem-solving properties of Pascal) they are both complex languages requiring far more than the 30 or 40 hours usually allocated to programming in a typical computer studies syllabus.

There is another language that scores full marks for each criterion, and is as simple to use as Basic. That language is Comal. Comal (common algorithmic language) was first developed in 1974 as a set of extensions to Basic to facilitate structured programming, and was not then a programming language in its own right. By 1979 so many changes had been made that it was

decided by the working group not to have Basic as a proper subset, and Comal-80 was born.

Comal is really a mixture of Basic and Pascal, retaining the simplicity of use of Basic with the comprehensive control structures of Pascal. Its file and string handling surpasses that of both, but the language really excels in its wealth of structured programming facilities. If the purpose of structured programming is to make coding readable, then Comal even scores over Pascal. While it is not used commercially it does allow the teacher to use accepted problem-solving techniques, such as top-down and stepwise refinement. Consequently, having mastered Comal, learning other languages becomes relatively painless. As it is an interpreted language (like Basic), it is ideal for the rapid solution of small to medium scale problems. It has one other similarity with Basic — poor data structuring facilities. Only integers, reals, characters and arrays (up to eight dimensions)

Illustration by Kieren Phelps

are supported by it.

Case study

To illustrate the strengths and weaknesses of Basic, Comal and Pascal, I'll explain how they each go about solving a very common problem in computing — that of sorting a list of numbers into ascending order.

The technique used is that of the 'ripple sort'. Given a list of numbers, you compare the first and second, second and third, third and fourth, and so on, swapping the numbers when necessary. When you have done this for the entire list, the largest number will have rippled to the top of the list. If you now forget about this last number (as it's the largest number and at the end of the list, it is now sorted) and perform a similar process on the rest of the list, the second largest number should ripple to the top of the remaining list (which is actually the second top position). We now move the top of the list down one again (forgetting about the top two numbers which are now sorted) and repeat the process until the top of the list becomes the first number. At this point, all the numbers must be sorted. The process is best described algorithmically (Fig 1).

'Today micros, running good applications packages and supporting a number of programming languages, are available at prices that schools can afford.'

As can be seen from the Basic equivalent of the algorithm (Fig 2), Basic does not reflect the nature of the underlying problem. In particular, if the reader did not know the purpose of the code, then the actual program statements would not provide many clues.

The coding is largely incomprehensible, looking more like a collection of mathematical equations than the solution to the simple problem of sorting numbers into order.

This is in striking contrast to the Comal coding (Fig 3). This program is very similar to the algorithm, being easily readable and therefore comparitively simple to follow. Descriptive variable names and the use of control structures mean that when a problem is reduced to algorithmic form, the encoding into Comal is straightforward.

The program was entered entirely in lower-case and without any indentation. It is a feature of Comal itself that causes programs to be presented in the format illustrated (Fig 3).

Pascal, like Comal, is highly suited to problem-solving and this is reflected in the coding (Fig 4). The layout in this case was achieved manually.

While both the Comal and Pascal programs are slightly longer than the Basic version, the extra coding pays

```
repeat
start at second number
       repeat
              if previous number > current number then swap numbers
              move onto next number

       until list finished
reduce list by one number (the one just sorted)
until end of list becomes the first number
```

Fig 1 Algorithm for ripple sort

```
 900 REM SORTS ARRAY "K" WITH "EL" ELEMENTS
1000 LET N=EL
1010 LET C=2
1020 IF K(C-1)<=K(C) THEN GOTO 1060
1030 LET T=K(C)
1040 LET K(C)=K(C-1)
1050 LET K(C-1)=T
1060 LET C=C+1
1070 IF C<=N THEN GOTO 1020
1080 LET N=N-1
1090 IF N>=2 THEN GOTO 1010
1100 RETURN
```

Fig 2 Basic program

```
 900 // Requires no introduction - self-documenting code
1000 PROC sort(REF array(),no_elements) CLOSED
1010   top_of_list := no_elements
1020   REPEAT
1030     current_element := 2
1040     REPEAT
1050       IF array(current_element - 1) > array(current_element) THEN
1060         temp := array(current_element)
1070         array(current_element) := array(current_element - 1)
1080         array(current_element - 1) := temp
1090       END IF
1100       current_element := current_element + 1
1110     UNTIL current_element > top_of_list
1120     top_of_list := top_of_list - 1
1130   UNTIL top_of_list = 1
1140 END PROC sort
```

Fig 3 Comal program

```
procedure Sort(var list:vector;NoElements:integer);
{ 'vector' is of type array[..] of integer }
var
   TopOfList,CurrentElement,Temp:integer;
begin
   TopOfList:=NoElements;
   repeat
      CurrentElement:=2;
      repeat
         if list[CurrentElement-1]>list[CurrentElement] then
         begin
            Temp:=list[CurrentElement];
            list[CurrentElement]:=list[CurrentElement-1];
            list[CurrentElement-1]:=Temp
         end;
         CurrentElement:=CurrentElement+1;
      until CurrentElement>TopOfList;
      TopOfList:=TopOfList-1;
   until TopOfList=1
end;
```

Fig 4 Pascal program

rich dividends when it comes to the subsequent maintenance of the software. By comparing the Comal and Pascal programs, readers should see what I mean about Comal being more suited to rapid problem-solving, as many of the nuances of Pascal (such as the declaration of all variables and the selective (and critical) usage of the semicolon) are not necessary.

Block-structured Comal

Quite apart from its readability, Comal scores over Basic for another equally important reason — it is a block-structured language. The routine is completely transparent to the rest of the program until it is called.

For example, in Comal, to sort an array called 'list' with 200 elements you would write:

EXEC sort(list1(),200)

The same routine could be used to sort an array called 'list2' with 50 elements by writing:

EXEC sort(list2(),50)

As the variables contained in the sort procedure are only active when it is called, programmers need not worry about using the same variable names in other parts of their program. When the procedure is left, the space occupied by the variables within it is recovered for use by the rest of the program. Large problems may be divided into a number of discrete blocks that teams of programmers may work on independently, without worrying about clashing with the coding created by others. Alternatively, useful libraries of routines (like this sort procedure) may be stored and merged with existing coding without worrying about how it will interface with the rest of the program. This is why Comal satisfies the vocational objective, as this is how programming is done commercially.

'Comal . . . provides education with a unique opportunity of rationalising its programming by introducing a structured approach to computer-based problem-solving.'

While all the above points apply equally well to Pascal, none of them are applicable to the Basic coding. The subroutine would require rewriting if you were to sort an array other than K, or if you altered the number of elements. If any of the variables used in the sort subroutine were used elsewhere in the program, then their integrity could not be guaranteed. This would make it impossible for teams of programmers to work independently on a problem as each would have to know what the other was doing.

Conclusion

With Acornsoft recently producing a version of Comal-80 for the BBC Micro, this language is now available to most schools. Comal has been popular in northern European countries such as Sweden and Denmark for several years, and the Scottish Education Department has announced that it is to be the language used for secondary school computing. Colleges of Further Education offer Comal as one of the programming options in the Scottish National Certificate course.

Comal is undoubtedly superior to Basic for learning programming, and can be squeezed into a tight computing syllabus. It provides education with a unique opportunity of rationalising its programming provision by introducing a structured approach to computer-based problem-solving.

This integrated approach would involve the use of appropriate programming languages throughout the education process: for example, Logo in primary education, Comal in secondary, and Pascal in further or higher education. If such an approach was adopted then skills acquired at one level would be transferable to the next.

Thanks to Microworld Systems Ltd for the use of the Comal and Pascal translators. END

SCREENTEST

MT+86 vs Pro-Pascal

Peter Ware has singled out Digital Research's MT+86 and Prospero's Pro Pascal, two 16-bit Pascal compilers, as indicative of professional development systems for the Intel 8086. Here he gives each package a thorough grounding, and pitches one against the other for comparison.

Both the 16-bit Pascal compilers compared in this review fall into the category of professional development systems. Both compile to relocatable (8086) machine code and both come with a range of software development aids for the serious programmer. The linkers provided can take object code generated by either the respective compiler, an 8086 assembler or even another language from the same stable, and create highly efficient and compact native machine code programs. Both products have been available for some time in several previous releases, including Z80 CP/M versions, and both are widely used by professional software engineers as essential tools of their trade.

The systems reviewed are in each case the latest offering from their respective manufacturers — Digital Research (DR) (of CP/M fame) is now shipping version 3.3 of its Pascal MT+86, and Prospero Software has its Pro Pascal available in version 2.1 (the linker supplied was version 2.2).

Both products are for the Intel 8086 family running MS-DOS (and PC-DOS) or CP/M-86, and both these versions were tested.

The professional software house is not likely to regard the price (just over £300) of either compiler as being excessive. Other programmers may be tempted to save money and purchase one of the many sub-£100 bargains currently on offer. This is false economy for serious use, unless you are prepared to be tied to one specific machine and, quite often, one (more or less) peculiar non-standard language syntax. Bugs are also not unknown.

Meaningful standards?

The semantics are another problem. Digital's MT+86 is billed as a 'Superset of ISO Standard Pascal', and Prospero is quietly proud of the Class A Validation Certificate awarded to its Pro Pascal compiler by the BSI.

The International Standards Organisation definition of the language (ISO 7185) was developed by a British team lead by Dr Tony Addyman, and its final recommendation (BS 6192) was officially adopted as the internationally agreed standard for the Pascal language.

The Pascal Validation Suite developed by Brian Wichmann and others at the NPL is available to compiler designers and other interested parties for little more than the cost of one of the compilers reviewed here. Now in version 4, it comprises a suite of several hundred programs that enable the accuracy of conformance to the Pascal language to be appraised.

Pascal is one of the very few languages which have sufficiently rigourous a definition to allow the validation of compilers. Both these products, one American and one British, acknowledge the importance of the ISO Standard, but they also both implement several essential extensions to the language (separate compilation, pseudo-dynamic character strings, command-line argument pick-up, and so on). All these features were tested in the course of the review.

No intermediate code-interpreted Pascal can live alongside the performance of these native code compilers, in terms of either speed (except MT+86 real arithmetic) or compact size of a complete executable program, especially so in Prospero's case. With either compiler, it is possible to create standalone code independent of operating system support.

The standard I/O routines available as source enable ROMable data entry and display systems to be engineered, although I have not used or tested these facilities. Other similarities between the products abound. Source code written for any version (8 or 16-bit) is notionally portable to any other system, excepting hardware-specific code, of course.

The Prospero system consists of 27 files, including example programs, the main components being the compiler (three passes), the linker, and run-time support libraries. There are four versions of the latter, for both the big and small Intel models, each with and without maths coprocessor support. This makes Pro Pascal the only Pascal compiler for the IBM PC to offer this

option.

The MT+86 package is organised somewhat differently. There is only one main library (only supporting the compact model), and the maths and transcendental routines are held in separate files, as in the 8087 support. A *BCD* reals library is also provided. In addition, both compilers supply a symbolic debugger, a librarian for constructing libraries from separately compiled segments or modules, and, as part of the Digital Research system, an assembler. This totals 49 lines, although overall size is about the same for each implementation (around 600k).

Installation

The compilers were both supplied and tested in two versions: one for MS-DOS/PC-DOS and the other for CP/M-86 (Digital's own operating system for the Intel 8086 family). The MS-DOS machine used was the Research Machines (RML) Nimbus (80186 engine clocking at 8MHz) kindly loaned by RML, and a Y-Data YD-8110 running CP/M-86 on the 8086 at a more modest 5MHz. The CP/M-86 machine uses conventional (not to say old-fashioned) twin 8in floppy disks with a total capacity of 2.4Mbytes, whereas the Nimbus PC2 had not only the new 3½in Sony micro-floppies (720k D/S), but a healthy 704k of RAM. Advantage was taken of the Nimbus configuration utility to reserve, initially, 512k as a 'silicon disk'. This is ideal for software development with compilers such as those under review that are entirely disk-based. The source text is created with a text editor or word processor (not supplied as part of the Pascal system), saved on disk and the compiler invoked.

Both products are multi-pass compilers, which means reading the source text three times: once to create a symbol table and check overall program structure; a second pass to do all the syntax checking; and then the actual code generation stage (this description strictly applies to the operation of the Prospero compiler, but both systems work in a similar way). This method gives the opportunity for code and speed optimisation, as well as enabling the building of syntax trees. If full advantage is taken of the latter, compile time error detection and the analysis of faulty program source can be made more effective.

As we shall see, both compilers behaved very differently in this respect. In any event, all this disk activity (including loading each phase of the compiler) can mean frequent cups of tea being made while compilation is in progress. If no errors are detected in the source (PROG.PAS, say) the relocatable object code file is produced, PROG.OBJ (standard Intel extension used by Prospero, Digital preferring its own .R86 format). The linker can now be run (Prospero is run automatically), again with disk access to the object code and run-time library(ies).

With the silicon disk able to hold editor, compiler, source text and run-time libraries, all disk activity occurs at an impressive pace. Compiling and linking trivial programs was accomplished in seconds, and 1000-liners in well under a minute. A large software system would typically comprise many such separately compiled segments, so only the linking process will be noticeably extended.

Compiling

Each compiler has a range of compile time options that are either embedded in the source text or appended on the command line. My own preference is for the command line method, as source code does not have to be altered. MT+ requires the T and W options controlling the enabling/disabling of features outside the ISO Standard to be within the text. Prospero offers a simple /S on the command line.

The mnemonics I generally used for Prospero were /sapling (for development compilation) and /g for the final one. These options control the generation of a .LOG file of the compilation (G), checks on index and array subscript ranges (I and A), pointer checks (P) and a line-numbered .PRN file (L). The N option creates a name symbol file, enabling use of the very impressive symbolic debugger. There is a PCONFIG utility to configure the defaults for these options permanently, if desired.

Many of these options are also available for MT+, but with more sensitive syntax. Prospero's configuration utility can also specify drives for finding and placing the files — very useful if high-capacity disks are not available. If the main run-time library (say, PASLIBS.OBJ for the small model) is rechristened PASLIB.OBJ, Pro Pascal will proceed to link automatically after a successful compilation. There is also an option (H) to 'hold' before the .OBJ code is written to disk, giving the possibility of changing disks and keeping source and code on separate volumes (Prospero appears to have thought of everything!).

For less experienced users, all the Prospero software goes into an interactive mode if no command line arguments are given. File names are politely requested, and available options are presented clearly with a simple Y/N answer to each choice. Digital's system is quite usable, but cannot match Prospero's caring and practical user-friendliness.

Linking

Prospero showed some major advantages here. Firstly, all the run-time support is in one (searchable) file called PASLIBS.OBJ or PASLIBB.OBJ, depending on whether the Intel small or big model architecture is required. Digital doesn't give you that option (important for any really large application) and only supports the compact model.

The MT+86 run-time routines are split into several libraries, not all of which are searchable. If your program uses real numbers, dynamic allocation (new and dispose), transcendental arithmetic functions (sin, cos, and so on), you must remember to specify the appropriate library files in the LINKMT command line. A typical link command for MT+86 will be linkmt b:prog, fpreals/s, trancend, mylib, paslib/s.

Only FPREALS and PASLIB are searchable, so some unnecessary and unused code may be linked. The logistics are also rather tricky with MT+ as it requires more memory than Prospero for compilation. I had to reduce the size of my RAM disk down to 448k to free more than 128k main memory. For any one session, a BAT (or SUB) file can be easily written to prevent the frustration of bleary-eyed tipying mistooks.

As previously mentioned, Prospero will link automatically if desired. Should user libraries be required, a line of the form: Prolink b:prog,mylib,paslibs/s will suffice. Again .BAT files are one alternative. To prevent attempted linking after an unsuccessful compilation, use: IF EXIST %1.OBJ, and so on.

Most of the early evaluation was conducted with programs off the shelf, both on CP/M-86 and MS-DOS (version 3.05). I had requested an external 5¼in floppy drive for the Nimbus system, as this can read IBM format as well as RML's double-density disks, and was a boon in saving hours of retyping source code.

In the main, Prospero refused to be caught out except by the most abtruse and artificial tests of the nooks and crannies of the ISO Standard. Pro Pascal lived up to its name and proceeded in an exemplary and very polite way to point out the various naughties in the programs that I submitted for its inspection. First attempts with MT+ were not so happy. Many errors were either not detected at all, or gave extremely ambiguous diagnostic messages. They were accompanied, in the main, by a welter of screen output, not much of it useful information. By contrast, Prospero's error messages were fairly uniformly accurate, and I soon became used to interpreting 'Symbol illegal in this context' as a sure sign of a missing semicolon. More importantly, whereas Pro Pascal seemed undeterred by the most flagrant abuse of Pascal syntax, the Digital Research compiler often got thoroughly confused. Errors would produce a pronounced knock-on effect, and generally meant abortion after the Nth repetition of the same suspect line.

Debuggers

Digital Research has supplied a debugger library with MT+ for some time. Although I did use it during testing, I found that it was somewhat difficult to use effectively. The source code is compiled with extra options (to gener-

ate source listing and symbol files) and then DEBUGGER.R86 is specified as the first external library at link time.

On executing the program, the debugger takes control and asks for full file names to be entered. If you're left in the dust by the documentation, there is an online help file. Subsequent commands are available to specify break points, and so on, similar to a low-level debugging utility. All commands are two characters: for example, DI <address> to display an integer variable.

Most of the information presented consists of hexadecimal digits, hi-lo byte pairs, and so on, and requires (sometimes considerable) interpretation. This was just one of many signs that DR's system is a rather specialised one. It may well appeal to the assembly language programmer who wishes to preserve maximum access to the hardware and operating system, but realises the need for a portable high-level structured syntax to express alogorithms, albeit low-level ones. The provision of an 8086 assembler (not fully Intel-compatible) with the MT+ system together with features such as the ability to incorporate INLINE code (few machine bytes, that is, not mnemonics) reinforce this view. Prospero offers a higher-level package, and nowhere is this more evident than when using the symbolic debugger, Probo.

The compilation options and linking are similar to that described for MT+, but when the program is ready to execute, some wonderful things start to happen. Probe is intelligent enough to find all the files it needs, unless you distribute them randomly around the system devices. The help file is really helpful for the first-time user, but I found that both this and the adequate documentation could be forgotten about within minutes. When needed, help (or just h) followed by another command whisks a screenful of clear, concise information and syntax specifications. Each command (DISPLAY, WATCH, LIST, ROUTE, CALLS, and so on) can be entered in full or abbreviated to a single character. Thoughtfully, the QUIT command *must* be typed in full, however, preventing inadvertent loss of execution at a testing moment. There is also continuous keyboard sensing for manual interruption of the program at any time that it is not awaiting input itself.

Unlike Digital's debugger, Probe is fully symbolic. I was most impressed with the ease with which any variables within the current scope can be inspected and altered. Multiple pointer references allow dynamic lists to be scrutinised, so that, for example, d tree ^. leftbranch ^ . item . code will print what you're after. There's a welcome absence of hexadecimal hieroglyphs, and full structures including arrays, records and sets can be examined. The WATCH command breaks on the value of a watched variable changing; LIST defaults to printing a short screenful of the source code starting from the statement about to be executed (but takes any line-number range). The Probe syntax is almost straight Pascal, apart from assignment where an equals sign is all that is required. STEP takes an optional line count (defaulting to single step) and, quite honestly, there's not a lot you can't do, and it's all at the high-level Pascal symbol level. The relief of not having to dive for a hex calculator and perform mental contortions to interpret displayed data bytes and addresses is a godsend.

The MT+ debugger has one useful advantage over Prospero's Probe, however. The BE(gin) command allows restart of execution from the top. No equivalent exists in Probe, so it is necessary to quit, reload and set up the breaks from scratch.

But there's more. Probe has a VDU command that sends a sequence of characters to the screen before any one of three operations:

Output sent from the program under test;

Probe diagnostic output; and

Probe user command line input.

Both Pro Pascal and MT+86 occupy about 600k as shipped, but only about a third to a half of this is needed online for normal operation. The four 5in or 8in low-density disks looked obtrusive beside the single 3½in microfloppy housing the complete Prospero MS-DOS implementation for the Nimbus. The usual library managers and cross-reference tools were all provided, and worked well.

Documentation

The documentation for both products is very similar in style, with nicely presented PC-format manuals — a change from the previous A4 size. Again, Pro Pascal scores on quality. The DR manual is good daisywheel quality, but Prospero has produced a superbly typeset and well-organised manual.

There is considerable room for improvement with the content of both manuals, however. I doubt the value of some of the instructional sections, particularly the introduction to the language for Fortran devotees, and the indexing and general organisation could be much better. The listed example programs are also of limited usefulness. DR scores here slightly, but, sensibly, Prospero includes some programs on disk.

Benchmarks

The *PCW* Benchmarks brought forth more problems from DR's language. I had two versions of a program containing all 15 tests: one a manual one, the other for when a system clock is available. Given the ability to declare EXTERNAL procedures and link with assembler, the MS-DOS clock on the Nimbus can be utilised to make life a lot easier for reviewers with a lazy streak, like myself. With Prospero, stooping to assembler isn't even necessary: a built-in time routine taking a four-integer record is available. MT+ also has EXTERNAL declarations, although the syntax is a little reverse Polish.

I had already had problems with LINKMT not working, although the compiler and all Prospero's software ran on both systems first time without problems. A new operating system release (3.1) speeded down from RML cured the link trouble, but I had many more restless hours before giving up attempts to read the clock from the MT+86 compiler. Digital has its own format .R86 object code, and I couldn't produce anything from its ASMT86 assembler that didn't hang (the documentation is as clear as mud, and the syntax is nothing like my Microsoft 8086 mnemonics).

Never mind, I thought. One of the many utilities that DR supplies (MT2INT) converts .R86 files into standard Intel .OBJ format (I read, with interest). All I had to do was run that on the MT+ .R86 files and then link the results with Prospero's Intel .OBJ linker, Prolink (Prospero wouldn't mind, would it?). Unfortunately, it won't get a chance to — DR's utility didn't work. The Benchmark timings for MT+86 were therefore compiled and run manually.

The fast native code from the review compilers coupled with the superb performance of the 8MHz 80186 in the Nimbus make it impossible to time the original tests accurately, even when run on the automatic clock version. Absolute accuracy cannot be guaranteed to be better than 0.2 seconds in this case, and with manually timed results perhaps 0.5 seconds is a realistic deviation. Therefore, for even 10 per cent accuracy, each test should last at least two to five seconds. This could be readily arranged for Prospero, as integers are stored in four bytes (DR's MaxInt is only 32767), but this would not necessarily be a fair test as the loop controllers would have more work to do. The only compromise is to run the tests for 30000 iterations (instead of 10000) using a redefined TYPE such as: ShortInt = 0 . . 32767;.

This will give all compilers a chance, whatever their integer representation,

of producing a real time for the shorter Benchmarks that is consistently measurable.

Results

The overall figure suggests that Pro Pascal is about 20 times faster than MT+86, but this is not really fair on DR. The exorbitant times taken on real and transcendental calculations completely swamp any slight gains the compiler has on other tests.

Although, like Prospero, the IEEE format for storage of reals may be used, unless the algorithms handle the bytes accurately, the results will be garbage for the most part. MT+ cheerfully prints out almost as many digits as you might reasonably ask for, but only the first half-dozen have any relevance. Prospero, on the other hand, knows its limitations and always displays trailing zeros after the significant figures. Both compilers have extended-width arithmetic, implemented rather differently. Again, Prospero is much the more reliable and easy to program.

Pro Pascal's accurate conformance to the ISO Standard language is enhanced with well-implemented extensions — a nucleus of essential ones, not a sprawling mass of knobs and frills. Apart from the external file-handling routines (erase, rename, and so on) the only noticeable omissions were things like functions to return the currently logged disk. I implemented the latter very quickly by using the system call and the SysRegs record type definition supplied by Prospero.

MT+86 does support the ISO level one conformant array scheme, Prospero being restricted to parameters of fixed and known size at compile time. If you need to process continually changing sizes of matrices, this may be important. For the most part, dynamic allocation of array slices will suffice even though they need a little more effort to program. Pseudo-dynamic strings are implemented *á la* UCSD in both implementations. Both compilers also have similar facilities for random access files, shared data segments, chaining and overlaying. The implementation of the latter, though, is very much to Prospero's advantage. One possible reason for a preference for MT+ might be when the bulk of your programming requires direct access to the hardware. The powerful extensions in DR's implementation may tell. Even here, Prospero has access to ports and data via routines and absolute 20-bit machine addresses or segment/offset values (both small and large models). For the advanced programmer, there are also facilities to install exception handlers (in both compilers) and, with Prospero only, random access text files, RAM files, system date and time procedures. The building blocks are provided to do almost anything.

Graphics support

An optional graphics interface library for systems supporting DR's GSX-86 interface is currently available from Prospero, not DR itself. Costing £80 and called Prospect, it is available for either MS-DOS or CP/M-86, not 8-bit CP/M.

Prospect provides access to all GSX devices and facilities without the tedium and inevitable problems of coping with the GSX normalised device coordinates.

Overflow and scaling problems are hidden from the programmer, who can write portable graphics applications entirely in Pascal (or the object code compatible Fortran compilers available from Prospero).

Prospero provides .OBJ run-time libraries for both the small and large models of the 8086 family architecture. Both Pro Pascal and MT+86 come with libraries of relocatable 8087 maths coprocessor code, but Prospero is unique in supporting the Intel Big Model on the IBM PC and compatibles. Together with the excellent optimisation and compact code generated, this implies that software systems could be engineered in Pro Pascal (and/or Pro Fortran) up to a much more substantial size than would be possible with MT+86.

There are a plethora of non-standard identifiers in MT+ for extra types, procedures and functions. These may be valuable to the systems programmer, and certainly give MT+ the appearance of a very powerful language (much of their source code looks rather like assembler). I have not found Pro Pascal's lack of many of these extensions a handicap — rather the contrary. The simple method of system calls and the few other extensions provided give all the building blocks necessary without unnecessary complexity.

Comparison

Some programmers may prefer certain aspects of DR's language, however, such as the EXIT procedure (analogous to that in C). For large systems the Prospero overlay management and other routines (ExecProg, FreeProg, ExitProg) seem to be preferable, although I have not yet tested their operation.

The overall quality of Pro Pascal reassures me that everything will work to the letter — perhaps that, in the long-run, is the most significant factor. Confidence in reliable tools is irreplaceable. The poor performance of DR's MT+86 compiler in handling real numbers is a severe handicap which, on its own, would rule it out of contention for serious consideration unless you're only interested in whole numbers. The speed of real arithmetic calculations compared to that for integers is by far the slowest I have ever encountered. Even the speed of writing to the screen changes gear dramatically at the drop of a real. Worse still, the displayed representation is grossly misleading, as digits beyond the first half-dozen are totally meaningless.

In addition, some of the other bugs in DR's implementation make it difficult to recommend this product. Every single program of any size that I attempted to compile and run on the MT+86 compiler gave trouble, necessitating rewriting source code and redesigning algorithms to overcome bugs inherent in the system; this despite the fact that most of these programs had been run on several standard Pascal compilers, both micro, mini and mainframe.

The erratic and non-standard behaviour of MT+86 defeats, in my view, one of the prime motivations for using Pascal. This is that the language is so well-standardised, so widely available and known, that high-level source can be transported to any compiler without alteration.

Mostly, of course, large programs tend to use one or two system or hardware specifics, but it is usually accepted that minor modifications will be required if that is the case.

Conclusion

My overriding impression is one of deep disillusionment with Digital Research's Pascal implementation, and a continuing and growing admiration for the sheer quality of Prospero Pro Pascal.

Perhaps all programmers will not agree. I have sometimes observed the 'real programmer' actually seeming to enjoy the painfully hard work entailed in coaxing recalcitrant systems into some semblance of life, but a bug-laden and unpredictable product holds no attractions for me.

MT+ is not for me. DR's seeming indifference to, and ignorance of, the Pascal language and its defined (not merely expected) behaviour is incomprehensible. The bugs extend from as trivial a level as the field width formatting not working properly to much more serious problems, both of the implementation and its use. DR may have risen on the crest of a *de facto* standard, but when clearly defined and internationally accepted standards exist, in this case for a programming language, it is wilful in the extreme to ignore them. This is all the more unjustifiable when conformance to those standards is implied in DR's own literature.

Prospero Pro Pascal is not only ISO validated, it is also a superb-quality and very full software development tool.

Prospero offers such a well-made implementation of ISO Standard Pascal that it may be used with confidence as a yardstick for other compilers.

Add to that the ease of use, the excellent error diagnosis and recovery, the stunning symbolic debugger, standardised syntax and semantics and, to cap it all, Prospero's Class A Validation Certificate, and there is no doubt at all which Pascal compiler I would make my first choice on any CP/M or MS-DOS system. END

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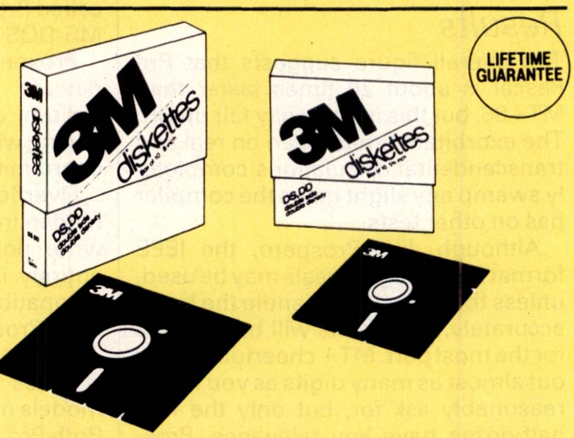

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Cornerstone

Infocom's Cornerstone is a data management package for users of the IBM PC and close compatibles who like a lot of interaction. Kathy Lang gets to know its various facilities.

For its originators, Infocom, Cornerstone is an unusual product, as the American software house is noted mainly for its adventure programs. As you might expect, therefore, there are some unusual aspects to the package, especially to the 'user image', the way instructions are given to control how the package works. Its basic functionality, however, is much more conventional, including a wide range of powerful features and with a few surprising omissions.

Cornerstone's strong points include a wide variety of data types and record display styles, excellent data validation facilities, flexible features for relating information in one set of records to those in another, good reporting capabilities, and the ability to import information in a wide variety of formats. It would be easy to use Cornerstone in conjunction with a spreadsheet package such as Lotus 1-2-3; not only are software facilities provided for this, but the manual also includes a good introduction to sensible ways of approaching the problem.

The area of greatest weakness is the direct retrieval of one or more records from a large number, especially if you want the records shown in a particular order. It will be easier to explain the problem when you have a more detailed grasp of the way Cornerstone works, so I'll describe the weaknesses in more depth in my conclusion. Also, due to the way relationships are created between sets of records, it would be difficult, if not impossible, to treat Cornerstone as a relational database with implications for the kind of data which can be handled.

The net result is that, for a reasonable volume of information with a simple or complex structure, consisting mainly of straightforward items such as numbers, codes, calculated fields and short text fields, Cornerstone is extremely easy to use and highly recommended. It is not so suitable for information containing large amounts of free text, such as library catalogues, and it could be unacceptably slow or tedious for large sets of data, especially where values of fields used for retrieval are changing often.

Constraints

The main limitations on running Cornerstone are shown in Fig 1. A notable feature of Cornerstone is the variety of types of information which it can distinguish. The common types of integer, numeric, date (several formats), character and Boolean (that is, Yes/No) are available. In addition, Cornerstone permits other types: time, calculated (in which case it may be an initial value, which does not change except when explicitly recalculated by a user-given command, or a derived value which is not stored but recalculated each time the record is processed), and sub-record. This last type

allows you to specify that there may be several instances of a group of fields attached to one record. For example, the main record may consist of a purchase order header containing a reference to the customer's name, address, and so on, with a sub-record for each item ordered giving stock code, description and price. It is possible to derive sub-record fields from main record items, and to aggregate sub-records to totals in the main record. Any field may be multi-valued: that is, any one record may include several values for the same item. For example, you may have several contact names at a single customer site.

Max file size	8Mbytes
Max record size	380 chars
Max no fields	158
Max field size	255 chars
Max digits	Not stated
Max prime key length	255 characters
Special disk format?	No
File size fixed?	No
Link to ASCII files?	Various formats
Data types	Num, Char, Date, Time, Ref+
Fixed rec structure?	Yes
Fixed record length stored	No
Amend rec structure?	Yes
Link data files?	Yes
Data files open	Eight (30 may be linked)
No sort fields	Unlimited
No keys	Unlimited
Max key length	255 chars, one field
Subsid'y indexes kept up-to-date	Yes
Data validation	Good
Screen formatting	Default, paint-a-screen
Unique keys	Optional
Report formatting	Default, paint-a-screen
Store calculated data	On input, batch recalc
Totals & statistics	Yes, good range
Store selecn criteria	Optional
Combining criteria	AND, OR, NO
>1 criterion/field?	Yes
Wild code selection?	Yes, in any test pos'n
Browsing methods	Any field
Interaction methods	Menu, commands
Reference manual+	****
Tutorial guide+	***
Reference card+	**
Online help+	****
Hot-line	Dealer support

Note: Maximum five stars possible

For a full explanation of abbreviations, see 'Database dossier', page 188, January issue

Fig 1: Features and constraints

Data validation is also reasonably powerful. In addition to direct checks on data values and the ability to restrict values to the elements in a list (called enumerated fields), you can also constrain field values to values already existing in a field in another file — for example, to ensure that only customer codes from existing customer records are entered on purchase orders.

File creation and indexing

The first step in creating a Cornerstone file is to set out the record definition; this process may involve two levels of detail. The short form contains just the name, a caption (to act as a screen prompt) and the field type, and this is the minimum you need to set up a record definition — all other attributes have default values. To set these yourself, you use the long form of the record definition. The attributes you can set in this way include mandatory fields, whether calculated field values are automatically maintained, and so on.

At the time the file is created, or subsequently, you can tell Cornerstone which fields are to be indexed to speed retrieval. Indexes are kept up-to-date, but they do not affect the order in which information is displayed. For the records to appear in a particular order they must be sorted, and this order is not maintained during editing and addition of records. However, sorting on fields which are indexed is quite fast, and you can specify that the data is always resorted at the beginning of a session, which helps a bit.

The indexes are used for all selections which involve searching for records starting with a particular sequence, but not those using more complex wild code specifications.

When a record structure has been defined, you can usually still amend the details; the only aspect which you cannot change is the field type.

In addition to defining the structure of individual files, you can also relate records in one file to those in another.

Data input and updating

Records may be entered or amended onscreen using a format which Cornerstone supplies, or one (or more) which you can set up yourself. To select records for updating, you can scroll through the file in its list form to obtain the one you want; you can flag all the records to be updated by scrolling through, marking as you go; or you can select a group of records by filling out a selection form (see 'Selection and sorting').

Most data management systems expect you to specify a key field value within the update procedure. Cornerstone's approach is less common, but the selection form process does use an index if there is one so the effect would be similar, if a little more cumbersome, for larger sets of data. When you have found an individual record, you can continue to scroll through the records in the current display order. If the records have been sorted by the appropriate field, you can find a group of records by going to the first and then scrolling in the manner employed by most data management systems.

Overall, the effect is to make updating in Cornerstone a little more tedious for larger data sets, and slicker for smaller sets, than a more conventional approach. 'Smaller' means small enough to scroll through comfortably, displaying one record per line — say, two hundred or so records.

When entering data, there are a variety of Cornerstone features which help to speed things up or to ensure accuracy. You can save a record at any time without necessarily having to enter all field values (except, of course, those which are mandatory), field values can be copied from the previous record, and derived fields can be prevented from alteration.

In addition to updating onscreen, you can amend records in batches where predictable changes are to be made to an identifiable group. For example, increasing the prices of all parts with a particular initial code letter by 10 per cent.

Screen display

Cornerstone provides three basic modes of viewing records onscreen: columnar (one record per line or group of lines); detailed (one field per line); and formatted (using a format you set up yourself). In each case, you can choose which fields are displayed. The initial columnar mode displays just the first field, while detailed mode starts by showing all fields. The display width of fields in columnar and detailed modes is controlled by the value entered during the record definition.

When Cornerstone is first used, the default display is columnar when viewing records and detailed when updating. In either case, you can define a different display format which may be automatically invoked on each subsequent use of view and update. Any printed report may be previewed on the screen.

Printed reports

Cornerstone provides some powerful reporting features, including the ability to design the layout onscreen, and sub-totals on sorted fields. You can produce a variety of aggregate items of information, such as totals, averages, counts, standard deviations and variances. You can also create new

SCREENTEST

values for calculated fields, using all the features described under 'Calculation'.

The ability to include unlimited text in reports would make it possible to use Cornerstone in a limited way to produce personalised letters. However, you could not go very far with including varying information within running text, as Cornerstone does not supply any facilities for amending the layout of the text line according to the length of the field value inserted — no word processing wrap-around features here.

Selection & sorting

The simplest method of selecting a sub-group of records is to list the whole file using the columnar format and flag the required records. To select a group of records using tests, you fill in a form

'(Cornerstone's) basic functionality . . . is much more conventional, including a wide range of powerful features and with a few surprising omissions.'

showing the values of fields which are to be tested. On a single selection form, you can enter several values for a single field (when the test is passed if any of these values is present), and values into several fields (when the record is selected if each field passes its test). It is possible to have several forms in the same selection, and combine them either with AND (the tests on this form must be passed) or OR (the tests on this form or its predecessor must be passed). You cannot 'bracket' forms to esnure the desired order of evaluation of several forms, so it is important to set up the selections in the right order.

Tests allowed include exact matches and matches using the usual range of relational operators, ranges, negation, and the use of wild codes (that is, testing for partial matches).

When a selection has been set up, it can be carried out at once or stored for subsequent use.

Records may be sorted in ascending or descending order by any field, and by any sequence of fields — there is no limit on the level to which sorting can be taken. However, records are not maintained in any particular order during editing and addition. Cornerstone indicates the current state of the file by displaying a message which reads 'sorted' immediately after sorting, and is changed to 'unsorted' when you go into update mode.

Calculation

Calculated values are allowed in stored records and in reports; you can also calculate totals, means, and so on. In any calculation a considerable display of functions is provided, including log, remainder, round, abs, some date and time field manipulation functions, financial functions such as net present value, and string functions such as substring and searching for one string within another.

Multiple files

Records in one file may be related to those in another. For example, you could specify that a file of sales orders is to be linked to a file of customer details, via a customer code, to enable invoices to be purchased using information from both files. You must specify one field in each file to be the link, and it must be possible to identify the linked record uniquely. The implication is that, while it would be easy to specify one-to-one relationships in Cornerstone, there would be some difficulty in specifying one-to-many relationships directly, although by using the multi-valued field type you could probably achieve an acceptable result. Many-to-many relationships could not, I think, be constructed within the current range of Cornerstone facilities.

The ability to restrict values in one file to those in another is a great help in ensuring the integrity of related files.

Tailoring

You can adjust various default attributes in Cornerstone, such as controls over scrolling. Probably more important to most users is the ability to customise such aspects as the way in which data is displayed in each of the

'. . . for those who always need to have information displayed in a particular order, the information would have to be frequently resorted.'

three formats and in each mode (view, update, and so on), but there is no ability to store sequences of keystrokes, still less a pseudo-programming language with conditional commands.

Security & housekeeping

Forms used to display records for updating need not include all the fields in a record. As you can ensure that a particular form is used to display records in update mode, this provides some answer to the need to allow junior staff to update some parts of records which also contain confidential information. However, it is relatively easy to invoke commands which revert to full display of the record. An alternative would be to put the two sets of information in two different files, linked by an appropriate field, but then absence of any protection mechanisms, such as passwords, would make security difficult to enforce unless the confidential file were kept on a separate floppy disk.

All the main file-handling requirements can be operated within Cornerstone, including deletion and the creation of security copies of data files.

Links with outside

Cornerstone can import data from files in dBaseII, PFS and Lotus 1-2-3 internal formats, in DIF format, and in ASCII text form either in comma-delimited records (mail-merge) or in records of fixed length. Cornerstone files can be

BM1	Time to add one new record	Inst
BM2	Time to select record by primary key	Inst
BM3	Time to select record by secondary key	Inst
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	46secs
BM5	Time to access 20 records using wild code	20secs
BM6	Time to index 1000 records on three-character field	3mins 15secs
BM7	Time to sort 1000 records on five-character field	2mins 31secs/48secs
BM8	Time to calculate on one field per record and store result in record	3mins 44secs
BM9	Time to total three fields over 1000 records	1min 53secs
BM10	Time to add one new field to each of 1000 records	Amend def

Time to import a file of 1000 records: 23mins 13secs

Note: *First time is for unindexed field, second for indexed field

Benchmark times recorded on IBM PC/XT/H

output in DIF, Lotus 1-2-3, and the two ASCII formats.

User image

Cornerstone is controlled by the use of commands — VIEW, DEFINE, EDIT, and so on. At each stage, a menu of available commands appears at the top of the screen (if you wish it to — it can be turned off as you become proficient). To select a command, you either move the cursor until a highlighted bar appears over the desired option and press RETURN, or you enter the first few letters of the command — enough to ensure uniqueness in the current menu.

Options are handled in a similar way; the result being that the novice user always has available a display of the current options, while an experienced user can set a task in motion by typing a few very abbreviated words and pressing RETURN just once.

Another good feature is the OPTIONS key; this provides a display of currently available values, for example a list of field names when setting up a report format. Good onscreen help is provided, always through the same function key, and includes supplementary information about error messages — an important but much neglected feature.

The ability to control the default modes of viewing, to have several display formats which can be stored by name, and the facility for choosing whether or not to store selection criteria are all very useful. I did not find the method of setting up selections so helpful, though, when the criteria became more complex — personally, I think there is a limit to what you can do with forms. I would prefer to see the use of commands extended to become an alternative to forms for setting up selection criteria. It would be a natural extension of Cornerstone's other features and would be much quicker for experienced users.

In some commands (DEFINE, for example, which allows you to set up file definitions and amend them) the use of sub-menus is unnecessarily extensive for experienced users, and a single command line could take the place of several menus here. Another fiddly criticism applies to the design of forms: there seem to be no commands which allow you to make groups of changes. For example, to design an entry form, you can start with the detailed default format and move fields to suit your tastes, but you cannot move a block of fields. If you want, say, the last six fields in the record to be moved up alongside the previous six, you have to shift them one at a time with cursor movements which are none too quick.

In addition to screen-displayed commands, there are some commands which are invoked from function keys. For example, completion of tasks such as setting up selection criteria is signalled by pressing the DONE key. Other functions include help and options.

Package	**Cost (£)**	**Summary**
Cornerstone	422.90	Powerful screen and report features, simple links between files, unlimited indexes kept up-to-date (but not used for ordering display). For IBM PC and close-compatible users with small-to-medium data sets who like lots of interaction. Good for varying length records.
Files & Folders	295	Good value, easy-to-use package, with basic linked file facilities (three open, eight linked). Good use of screen when setting up files. Good list and sort features: no letter-writer. Menu-driven, no tailoring or batch processing. Usable manuals, no road map.
Power-base	395	Powerful database management system with linking of many files, batch updating, up-to-date indexes, reporting adequate (no letter-writer), excellent links with other packages, for example Lotus 1-2-3. No system development tools. Easy to use, documentation excellent.
TIM IV	295	Good value for money as an easy-to-use package with basic features. Extensive indexing gives flexible direct access and ordering. Especially suitable where you need simple relationships between files, or output to range of spreadsheet formats.

Comparison of similar data management packages

Summary

Supplier:	Softsel
Telephone:	(01) 844 2040
Cost:	£422.90
Systems:	PC-DOS
Version reviewed:	1.0
Type:	Novice users, structured data
Features:	Easy-to-use data management system for single and linked files. Powerful and flexible display and reporting, powerful indexing, batch updating. Excellent links to other packages including Lotus 1-2-3. OK for varying length records as it stores data only.
Drawbacks:	Only for IBM PC and close compatibles. Access for onscreen editing rather cumbersome: sorted order not maintained.
Ease of use:	Excellent: lots of help for novices, abbreviated commands for experienced users.

Documentation

Cornerstone comes in a large plastic box with a beginner's guide (using example files which are distributed with the software), a two-volume owner's handbook, a quick reference card and a keyboard template. There is also a 'getting started' booklet which instructs you how to install the system.

The documentation is well set out, extremely readable, and has a good index. In particular, I like the way different typefaces have been used to cue different kinds of information. Some of the language was rather folksy for my tastes, but I expect most micro users are used to this style by now.

Conclusion

Cornerstone is a powerful package, but is nevertheless very easy to learn and use. It has the ability not only to handle single files, but also groups of files in a database. The viewing and reporting features are powerful and well implemented. I particularly like the ability to have both an abbreviated list format and a more detailed one-record-per-screen format.

It is not quite as easy as it should be to retrieve individual records for editing, and the separation of indexing and sorting means that, for those who always need to have information displayed in a particular order, the information would have to be frequently resorted. On a relatively small database, neither of these drawbacks would be a great cause for concern, but when analysing several hundred or a thousand records per file it could be more of a nuisance.

There is no true built-in letter formatting facility, nor any spreadsheet or graphics functions, but links to the appropriate packages could be easily effected through the convert utility. END

Interpretative Logo

Harvey Mellar concludes his Teach Yourself Logo series by putting the language into practice: he writes a mini-Logo interpreter in Logo

In this final part of the Logo series, I'll describe Logo using Logo itself. I am going to write a mini-Logo interpreter in Logo. This kind of circularity is not as silly as it may sound; after all, we do it all the time with human languages.

Two major benefits are expected to come from writing this interpreter. Firstly, a better understanding of how Logo works. Secondly, I'll be developing an outline for a real Logo interpreter, which could form the basis for writing the interpreter in another language.

The interpreter will deal with the Logo fundamentals such as list processing, conditionals, attaching values to inputs, controlling recursion and defining new procedures, but will omit a lot of the frills.

Given these basic features, you could go on to write procedures in mini-Logo that would expand its capabilities to resemble those of a full Logo.

Clearing the ground

Before going on to a detailed description of the interpreter, it's worthwhile having a quick look at a few 'helping' operations and some new primitives that are used by the program.

Within the interpreter, several sets of values are stored as 'association lists'. A simple example of an association list would be a list of company personnel together with their telephone extension numbers. We might have Jones on extension 325, Smith on 643, and so on. Each name is associated with an extension number, so the telephone list is a collection of pairs such as [JONES 325] and [SMITH 643]. Within these pairs the first part (the name in this case) is referred to as the key, and the second part (the extension number here) as the value. The telephone 'association list' is the list made up of these pairs — [[JONES 325] [SMITH 643]].

We shall only need to perform two kinds of operations on association lists — adding a new pair to the list, and looking up the value corresponding to a particular key.

M.ADD adds a new element to a list,

```
TO M.ADD :KEY :VALUE :ALIST
  OUTPUT FPUT LIST :KEY :VALUE
    :ALIST
END
```

As an example, M.ADD "ALLEN 543 [[JONES 325] [SMITH 643]] would output [[ALLEN 543] [JONES 325] [SMITH 643]].

Looking up values is done by M.ENTRY. This either returns a list composed of the key together with its value, or it returns the empty list if the key is not in the list.

```
TO M.ENTRY :KEY :ALIST
  IF EMPTY? :ALIST THEN OUTPUT []
  IF :KEY = FIRST FIRST :ALIST THEN
    OUTPUT FIRST :ALIST
  OUTPUT M.ENTRY :KEY BUTFIRST
    :ALIST
END
```

There are two other 'helping' functions used in the program — M.BUT and M.REMOVE.QUOTES.

```
TO M.BUT :N :LIST
  IF :N = 0 THEN OUTPUT :LIST
  OUTPUT M.BUT :N - 1 BUTFIRST
    :LIST
END
```

M.BUT is an extension of BUTFIRST; it is used to remove several elements from the front of a list. M.BUT 3 [A B C D E] returns [D E] — the list minus its first three elements.

```
TO M.REMOVE.QUOTES :LIT
  IF WORD? :LIT THEN IF FIRST :LIT = "
    " THEN OUTPUT BUTFIRST :LIT
  OUTPUT :LIT
END
```

M.REMOVE.QUOTES is used to remove the quotes from the front of a word. This procedure is needed as Logo is somewhat inconsistent in the way it handles words. Numbers are regarded as words and yet they do not need to be preceded with the quote sign like other words.

M.REMOVE.QUOTES removes the " from any word which has it, but leaves other inputs untouched.

I've introduced three new primitives in this program, but none of them involve any very new ideas.

LOCAL enables you to declare a variable as local to a procedure.

SENTENCE takes two inputs and puts them together to make a list, which is slightly different in effect from FPUT. FPUT [A] [B C] produces [[A][B C]] whereas SENTENCE [A] [B C] produces [A B C].

ITEM is used to get at an element of the list other than the first. ITEM 3 (A B C D E] returns the third element of the list, that is, C.

The interpreter

All procedures used to implement the interpreter begin with M. (for example, M.RUN, M.APPLY) and all primitives in the mini-Logo begin with * (for example, *FIRST, *DEFINE).

The interpreter only deals with a few primitives and it makes some simplifying assumptions about the form of its input, so I'll explain first what it can and can't do.

The interpreter implements the operations *FIRST, *BUTFIRST, *FPUT, *EMPTY? and the commands *OUTPUT, *IF, *STOP, *DEFINE, and *PRINT.

A single line of direct input, or any line of a procedure, must consist of a command optionally followed by one or more operations together with their inputs. For example, *PRINT *FPUT *BUTFIRST [X Y Z] *FIRST [[A B C] [D E F]].

*IF is a command, although in standard Logo IF can be either a command or an operation. It must be followed by three lists: the first represents the condition; the next the action to be performed if the condition is true; and the last the action if the condition is false. The action parts must either be of the same form as a line of input or be the empty list. For example:

```
*IF [*EMPTY? [A F]] [*PRINT "YES]
  [*PRINT "NO]
```

The mini-Logo does not include an editor; procedures are defined using *DEFINE. The format used is shown by this example:

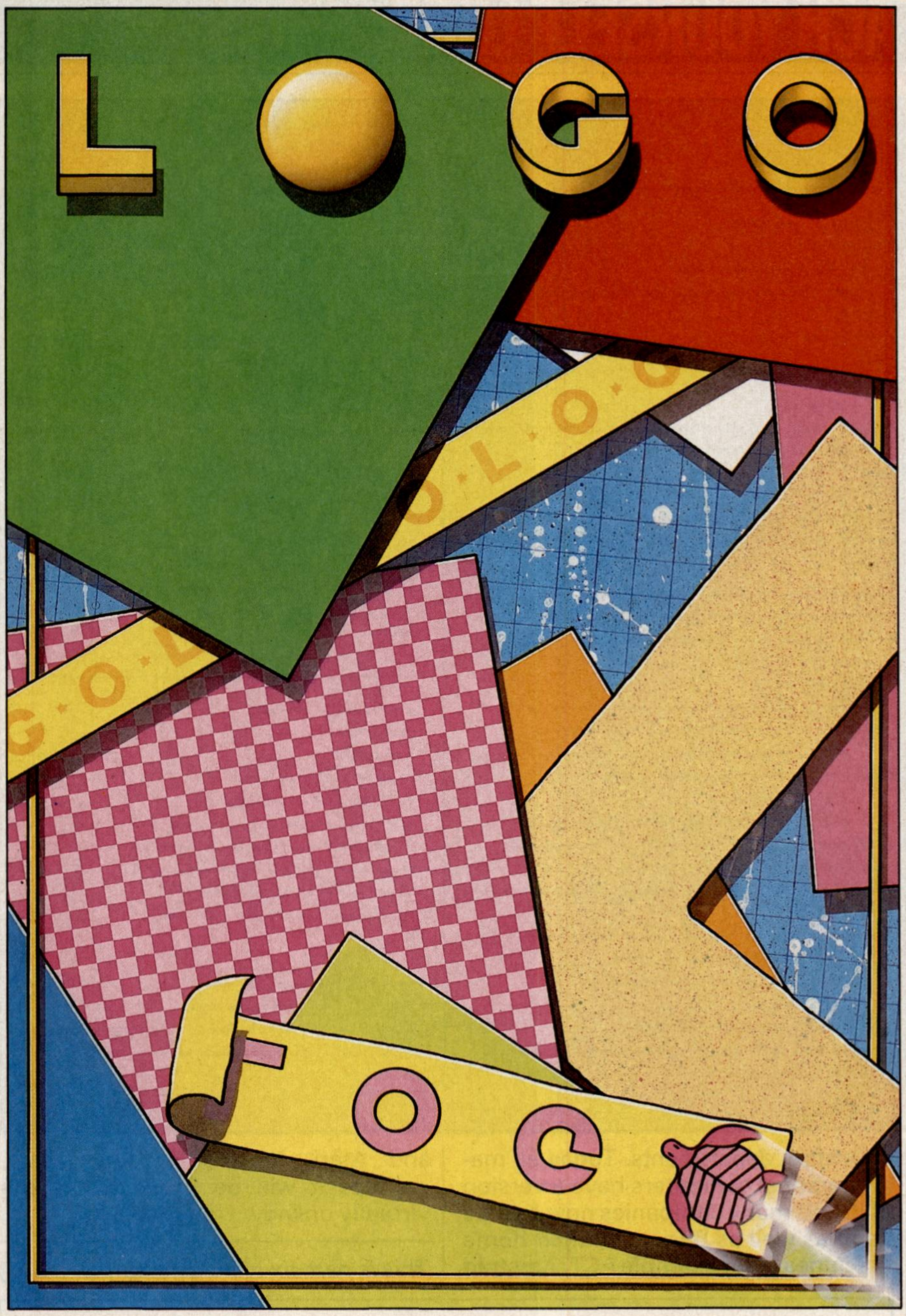
```
*DEFINE "TRI [[:LIST] [*PRINT :LIST]
  [*IF [*EMPTY? :LIST] [*STOP] []] [TRI
  *BUTFIRST :LIST]]]
```

which corresponds to the more normal way of writing the definition:

```
TO TRI :LIST
  *PRINT :LIST
  *IF [*EMPTY? :LIST] [*STOP] []
  TRI *BUTFIRST :LIST
END
```

The definitions of procedures are kept in a global variable called PROCEDURES. This is an association list in which the procedure name is the key, and the value is the text of the procedure definition. One item of PROCEDURES might be:

```
[TRI [[:LIST] [*PRINT :LIST] [*IF [*EMP-
  TY? :LIST] [*STOP] []] [TRI *BUT-
  FIRST :LIST]]]
```



There are two other global variables used in the program:
PRIM.LIST — this is an association list consisting of the names of the primitive operations of mini-Logo together with the number of inputs they take.
DONE — this is a flag indicating when a *STOP command has been met.

The values of local variables (or inputs) are kept in a local variable called VARS. This is another association list in which each element consists of the name of the variable plus its value.

How the program works

To start the interpreter for the first time use M.SETUP; this initialises PRIMLIST and clears out the procedure list before it calls M.LOGO. To keep the procedure definitions from a previous time, you would simply begin with M.LOGO.

M.LOGO prints a prompt, receives a line of input from the keyboard, and sends it for evaluation to M.RUN. The other input to M.RUN represents the association list containing the variables, which is initially empty. M.RUN will always return a value. This value should be the empty list if everything is OK: if anything else is passed back, an error message is given by M.REPORT.

M.RUN does much of the heavy work of the interpreter. It evaluates the first element in the input line and decides how to proceed with evaluating the rest of the elements in the line. There are five possibilities:

1) The line is empty, in which case it stops and outputs [].

2) The first element is a constant (M.CONSTANT? is used to check for this), in which case it leaves it alone (other than stripping the quotes from before words) and adds the result onto a list formed by evaluating the rest of the line.

3) The first element is a variable, in which case it replaces the variable by its value. It is the task of M.VALUE to determine this value or signal an error if there isn't one. The result is added onto a list formed by evaluating the rest of the line.

4) The line is a conditional. It depends on the result of evaluating the condition as to which of the other two lists is evaluated. The task of running the correct set of actions is handled by M.IF.

Look closley at how M.IF works. The first thing done is (M.RUN :COND) and this either has the result [TRUE] or [FALSE]. The first element of this result is then TRUE or FALSE. The trick is to treat this result as a variable name and get the value associated with it by using THING. This gives one of the action lists, which can then be run by M.RUN.

5) None of the above apply, so the first element must be the name of a procedure (whether primitive or user-defined). It evaluates the rest of the line and passes the result over to M.APPLY so that it can apply that procedure to the list of inputs.

Within M.APPLY there are three sets of options:

1) The procedure is a primitive command, in which case it is carried out and processing is halted by outputting a value (usually []). *DEFINE causes a call to M.DEFINE which adds the definition to the front of the list PROCEDURES.

2) The procedure is a primitive operation, in which case the operation and its inputs are replaced by their result within the input line, and the new line is output. This involves determining from PRIM.LIST how many inputs the operation is supposed to have.

3) The procedure is a user-defined procedure; in this case the task is passed over to M.APPLY.PROC.

M.APPLY.PROC calls on M.DEFN to look up the definition of the procedure or give an error message if it is not found. The definition of the procedure together with the values of its inputs (which are assigned to the local variables by M.ASSIGN) are sent to M.RUN-.PROC to evaluate, and the result is used to replace them within the input line.

M.RUN.PROC calls upon M.RUN to run the procedure line by line, keeping a look-out for the DONE flag being set, indicating the end of a procedure.

We could hardly hope to write a full interpreter in so short a space. There are a number of problems with the program, some of them quite major, others fairly minor. Here's a few to be going on with:

1) There are no turtle graphics and no arithmetic. The arithmetic is the bigger problem, particularly if infix operations are required.

2) We have, in effect, made all commands into operations, since everything passes back a result even if it is only the empty list. Advocates of functional programming might well claim that this is no bad thing!

3) New procedure definitions are added at the front of the list PROCEDURES — they do not replace old definitions of the same name, as they should.

4) There is almost no error handling.

```
TO M.SETUP
 MAKE "PRIM.LIST [[*FIRST 1] [*BUTFIRST 1] [*FPUT 2]
[*EMPTY? 1]]
 MAKE "PROCEDURES []
 M.LOGO
END

TO M.LOGO
 PRINT1 ">
 ; RUN THE NEXT LINE INPUT FROM THE KEYBOARD
 ; SETTING THE LIST OF LOCAL VARIABLES TO []
 M.REPORT M.RUN REQUEST []
 M.LOGO
END
```

```
TO M.REPORT :RESULT
 IF NOT EMPTY? :RESULT THEN PRINT [YOU DONT SAY WHAT TO DO
WITH RESULT]
END

TO M.RUN :S :VARS
 ; EMPTY
 IF EMPTY? :S THEN OUTPUT []
 LOCAL "SYMBOL LOCAL "REST
 MAKE "SYMBOL FIRST :S
 MAKE "REST BUTFIRST :S
 ; CONSTANT
 IF M.CONSTANT? :SYMBOL THEN OUTPUT FPUT ( M.REMOVE.QUOTES
:SYMBOL ) ( M.RUN :REST :VARS )
 ; VARIABLE
 IF FIRST :SYMBOL = ": THEN OUTPUT FPUT ( M.VALUE BUTFIRST
:SYMBOL :VARS ) ( M.RUN :REST :VARS )
 ; CONDITIONAL
 IF :SYMBOL = "*IF THEN OUTPUT M.IF ( FIRST :REST ) ( ITEM 2
:REST ) ( ITEM 3 :REST ) :VARS
 ; PROCEDURE
 OUTPUT M.APPLY :SYMBOL ( M.RUN :REST :VARS ) :VARS
END
```

```
TO M.CONSTANT? :X
 IF NUMBER? :X OUTPUT "TRUE
 IF LIST? :X OUTPUT "TRUE
 IF FIRST :X = "" OUTPUT "TRUE
 OUTPUT "FALSE
END
```

```
TO M.VALUE :NAME :VARS
 LOCAL "VAR
 MAKE "VAR M.ENTRY :NAME :VARS
 IF EMPTY? :VAR THEN ( PRINT [THERE IS NO NAME] :NAME )
TOPLEVEL
 OUTPUT LAST :VAR
END

TO M.DEFINE :S
 MAKE "PROCEDURES M.ADD ( FIRST :S ) ( LAST :S) :PROCEDURES
 ( PRINT FIRST :S "DEFINED )
END

TO M.IF :COND :TRUE :FALSE
 OUTPUT M.RUN THING FIRST ( M.RUN :COND :VARS ) :VARS
END
```

```
TO M.APPLY :PROC :INPUTS :VARS
 LOCAL "RESULT LOCAL "NUMB
 ; PRIMITIVE COMMANDS
 MAKE "DONE "FALSE
 IF :PROC = *DEFINE THEN M.DEFINE :INPUTS OUTPUT []
 IF :PROC = "*STOP THEN MAKE "DONE "TRUE OUTPUT []
 IF :PROC = "*PRINT THEN PRINT :INPUTS OUTPUT []
 IF :PROC = "*OUTPUT THEN OUTPUT :INPUTS
 ; PRIMITIVE OPERATIONS
 IF :PROC = "*FIRST THEN MAKE "RESULT FIRST FIRST :INPUTS
 IF :PROC = "*BUTFIRST THEN MAKE "RESULT BUTFIRST FIRST
:INPUTS
 IF :PROC = "*FPUT THEN MAKE "RESULT FPUT FIRST :INPUTS ITEM
2 :INPUTS
 IF :PROC = "*EMPTY? THEN MAKE "RESULT EMPTY? FIRST :INPUTS
 ; REPLACE THE OPERATION AND ITS INPUTS
 ; WITHIN IN THE LIST BEING INTERPRETED
 ; BY THEIR RESULT
 MAKE "NUMB M.ENTRY :PROC :PRIM.LIST
 ; NUMB CONTAINS A VALUE IF :PROC IS A PRIMITIVE OPERATION
OTHERWISE IT WILL BE EMPTY
IF NOT EMPTY? :NUMB THEN OUTPUT FPUT :RESULT M.BUT ( LAST
:NUMB ) :INPUTS
 ; GET DEFINITION
 OUTPUT M.APPLY.PROC :PROC :INPUTS :VARS
END
```

```
TO M.APPLY.PROC :PROC :INPUTS :VARS
 LOCAL "PROCEDURE LOCAL "NUMB
 MAKE "PROCEDURE M.DEFN :PROC
 MAKE "NUMB COUNT FIRST :PROCEDURE
 ; REPLACE THE PROCEDURE AND ITS INPUTS
 ; WITHIN THE LIST BEING INTERPRETED
 ; BY THEIR RESULT
 OUTPUT SENTENCE ( M.RUN.PROC BUTFIRST :PROCEDURE ( M.ASSIGN
FIRST :PROCEDURE :INPUTS :VARS ) )  ( M.BUT :NUMB :INPUTS )
END

TO M.DEFN :NAME
 LOCAL "DEFN
 MAKE "DEFN M.ENTRY :NAME :PROCEDURES
 IF EMPTY? :DEFN THEN ( PRINT [THERE IS NO PROCEDURE NAMED]
:NAME ) TOPLEVEL
 OUTPUT LAST :DEFN
END
```

```
TO M.RUN.PROC :LIST :VARS
 LOCAL "RESULT
 ; FINISHED?
 IF EMPTY? :LIST THEN OUTPUT []
 ; RUN NEXT LINE OF THE PROCEDURE
 MAKE "RESULT M.RUN FIRST :LIST :VARS
 IF :DONE THEN MAKE "DONE "FALSE OUTPUT []
 IF NOT EMPTY? :RESULT THEN OUTPUT :RESULT
 ; RUN THE REST OF THE PROCEDURE
 OUTPUT M.RUN.PROC BUTFIRST :LIST :VARS
END

TO M.ASSIGN :NAMES :VALUES :VARS
 IF EMPTY? :NAMES THEN OUTPUT :VARS
 OUTPUT M.ASSIGN ( BUTFIRST :NAMES ) ( BUTFIRST :VALUES ) (
M.ADD BUTFIRST FIRST :NAMES FIRST :VALUES :VARS )
END
```

A mini-Logo interpreter written Logo

5) Each mini-Logo primitive has a fixed number of inputs, whereas in standard Logo many primitives can have a variable number of inputs.

6) I have not touched the problem of global variables, or that of changing the value of variables within a procedure by using MAKE.

I've left plenty for you to do!

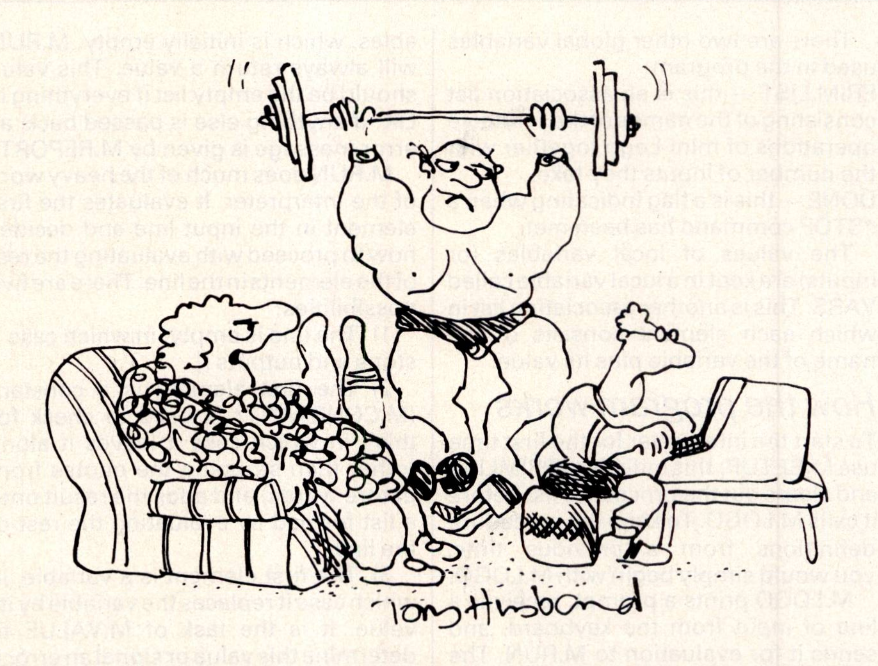
Conclusion

My intention in this series has not been to give you examples of perfect Logo programs which you can copy, but rather to give starting points for exploring and developing new programs. I have taken a few ideas to some depth because it is important to point out just how Logo could be used to deal with them.

Logo's strengths lie in its ease of use and its power. It has limitations, the most obvious of which are its slowness and greediness for memory. More fundamental criticisms of the language attack it for having moved away from the pure 'functionalism' of Lisp towards becoming a more procedural language. At the moment, Logo is primarily a language for learning, for experimentation, and for having fun with.

Four years ago Logo was an almost unknown language outside university education departments. Today all major personal computers have a version of it, and many companies now bundle Logo as well as Basic with their home machines—for example ACT, Amstrad and Atari. In another four years, perhaps it will be Basic that is the virtually unknown language.

This is part six of six-part series. **END**



'I hope you realise what a terrible disappointment you are to your father.'

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The history and potential future of all those lovable robots is lavishly described, and there's a 6502 manual to try to get excited about. David Taylor reviews this month's book choice.

All arms and legs

Title: The Robot Book
Author: Richard Dawson
Publisher: Windward
Price: £7.95 (paperback)

The freakishly affected Andy Warhol claims always to have dreamed of being a robot, and for an American TV special a couple of years ago he spent $400,000 having a waxen image made of his head with over 50 moving parts and the eerie capacity to look rather more lifelike than the pasty-faced real thing.

To date I think that's my favourite robot, although running a close second is Jacques Vaucanson's 18th-century wooden mechanical duck which made *le tout Paris* gasp as it took in grain, digested it through a clockwork gut, and for a finale left a mess on the carpet.

Both these awesome devices typify aspects of robotics which have always bedevilled the science: breathtaking ingenuity which nevertheless always falls short of an imagined ideal, the urge to make machines which resemble or imitate living creatures but which never do compare, and an air of well-I-never inventiveness directed towards fascinating but often quite pointless ends.

Robots are, of course, by definition sci-fi toys with their roots in our deep-seated desire to have mechanical devices relieve us of drudgery. That, at any rate, robots can now do in an industrial context and highly sophisticated they are at it. They are useful, too, in environmentally hostile or downright dangerous surroundings (like deep-sea probes or the 'Wheelbarrow' deployed by the army to dispose of bombs). Increasingly, they are experimental tools which can help us fathom the detailed nature of movement, manipulation and logical progress. Not to mention big box-office when they're humming and clucking

about inside Hollywood's fevered vision of the shape of things on legs to come.

Richard Pawson sticks his neck out and suggests that within five years or so we shall all be keeping robot pets. They won't need feeding or house-training, he points out, but they might well be programmed to want exercise, so encouraging their owner to get out of doors. Mr Pawson is, on the other hand, scornful of predictions that robots will ever be much use as domestic step-an'-fetchits. He sees intelligent lawn-mowers remaining a popular myth for now.

This, as you may have inferred, is by no means a sober-sided, academic study, but it is a hugely entertaining and lavishly-illustrated book which cogently describes the history, current state and future potential of robots to an eager but non-specialist reader.

Kids I guarantee will love it as there's a sizeable section on construction projects — harnessing lego for a buggy or an android, making a robot arm (just the job for grabbing dozing parents), plus instructions for a walking biped or hours of fun fixing up Fischertechnik-based robots which can deal cards or play draughts.

Parents, too, must approve as the rest of the book is intensely educational, while grabbing your interest with its excellent mix of facts, insight, anecdotes and pretty pictures.

Highly recommended as Christmas looms.

Mac of all trades

Title: Macintosh — a Concise Guide to Applications Software
Author: Dirk van Nouhuys
Publisher: Wiley Press
Price: £19.60 (paperback)

The Mac has caught on despite its shortcomings as a serious business tool (lack of memory, bad keyboard, sluggish drive) and its priceyness for home use, even despite never-ending heebie-jeebies at Apple as it struggles to determine what commercial life is all about.

Quite right, too, as the Mac is without doubt a superlative machine which has revolutionised micro-friendliness, and which with remarkable speed has spawned a whole new library of software as welcome for its varied flexibility as for ease of use.

On the face of it, then, Dirk van Nouhuys (who may sound like a misprint but turns out to be one-time Program Manager for systems, language and data communications manuals in the Lisa division of Apple) is onto a winner with this instant software summary.

Yes and no, it turns out. Yes insofar as it is quite handy to have quick lessons on running Microsoft Word or Chart, setting up pfs File and Report, Think-Tank or Multiplan all in one slim volume. No insofar as it is wearisome to have so much of the book given over to rewriting the Mac's already lucid manuals, or to making such fatuously dimwitted observations as 'On the Macintosh you point to make things happen' or 'Using the mouse is a physical activity like walking or swimming (but not as hard to learn)'.

Ironically, of course, the Mac's built-in mateyness ought almost to do away with the need for hand-holding manuals in the first place, and indeed for experienced users of MacWrite, MacPaint and MacDraw, for instance, I'd imagine a good two-thirds of this book is dispensable.

You may perhaps wish to learn how Dirk van Nouhuys uses MacDraw to make little labels for his collection of music cassettes; then again you may not. You may wish to grasp the techniques of transferring files to and from an IBM PC using PC to Mac and Back; or not, if you do not happen to have an IBM PC as well as a Mac. Then there's a chunk on fixing up MacTerminal to contact The Source via Telenet, but mind you move house to the States first.

Patchy at best, I'm bound to say. For nearly 20 quid you could well ask for more.

Do not pass Logo

Title: Forward 100: Logo and Your Child: A New Way of Learning
Author: Ray Hammond
Publisher: Penguin
Price: £5.95 (paperback)

I imagine Ray Hammond does sometimes sleep. You do begin to wonder, though, noting that between fiction and TV dramas he's recently published decent books on three of today's most talked-about micro topics — communications, Logo and word processing; besides his daft series for kiddywinks featuring the redoubtable Bobby Byte.

This book is about children, and the profound effect on their education of the computer revolution in general and the language and philosophy of Logo in particular. It is for parents and teachers who suspect that it's about time they got to grips with the smart-thinking US's controversial Logo (in which, by the way, FORWARD 100 is the first command you learn) and its claims to promote a startlingly fresh approach to logical conceptual thought in schools.

Ray Hammond does a thorough and polemical job. By the time you have staggered through nearly 300 dense pages, you'll have a firm grasp of Logo technique and what it strives to achieve. You'll be clued-up on appropriate hardware, will have a structured plan of how to proceed, and will have digested the experience of others described in a series of case histories. It's also likely that you will have a headache.

After a slow start in the UK (where we've clung stubbornly to Basic) the merits of Logo's top-down methods of reducing complex problems to more easily managed bits are now more widely understood, and the previous tendency to tool about with turtles, using watered-down versions of proper Logo, is in decline. Ray Hammond clearly believes it's about time. His paperback paean is persuasive.

Berk's steerage

Title: Micro-Prolog & Artificial Intelligence
Author: AA Berk
Publisher: Collins
Price: £9.95 (paperback)

Dr Berk (who really, you'd think, might change his name) here writes an eminently lucid but nevertheless testing introduction to what is a vexed and complex issue as well as a brain-twisting language — a micro-tailored dialect of Prolog, around which most current research into artificial intelligence is centred and much of the operation of fifth generation computers will hinge.

Crumbs. Programming in micro-Prolog is allegedly eased by a package of special modules and 'front-end processors', one of which we get a good go on and which is cheekily called Simple. Still, wait till you try parsing. And Dr Berk insists we're only scratching the surface of list processing and expert systems in this book.

So far as I was able to get with smoke coming out of my IBM XT and both ears, it's mesmerising stuff provided you have the stamina or incentive to persevere, and would *have* to be easier used as a textbook to lectures from Dr Berk or other fine polymath.

Gonna ride the 6502

Title: 6502 User's Manual
Author: Joseph J Carr
Publisher: Reston (Prentice-Hall)
Price: $15.95

Okey-doke, guys, here comes one for all you Apple II-with-the-lid-off freaks. All-American Joe Carr is all kinds of crazy for hacking the night away doing his pin-outs and his interfacing chores, assembling and programming in machine code with his well-thumbed manuals beside him — this one, pal Joey says, is intended to become dog-eared and worn from constant reference, oh yeah, as we Branch on Carry Clear, Return form Interrupt, Set Carry Flag and Push Accumulator Contents Onto External Stack, hot-diggety-dog.

If you have the faintest idea what I'm on about, I dare say you will relish this esoterically action-packed book.

If not, I wouldn't bother. END

TJ'S WORKSHOP

Our monthly selection of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to TJ's Workshop, PCW, 32-34 Broadwick Street, London W1A 2HG. Please keep your contributions concise and enclose a stamped addressed envelope if you want them returned. We will pay £5-£30 for any tips we publish. PCW can accept no responsibility for damage caused by using these tips, and readers should note that any hardware modifications may render the maker's guarantee invalid.

WORDSTAR FILE CONVERSION

These routines make it easier to transfer text files between WordStar and other word processors. The first takes a file produced by answering 'Y' to WordStar's 'DISK FILE OUTPUT (Y/N)' question when printing a file and answering 'N' if asked 'FORMAT OUTPUT FOR RE-USE BY WORDSTAR', and taking the default for all other questions.

When a file is produced this way, and then run through the first of the programs, all the printer control codes are stripped out, leaving an output file which can be used by another word processor or transmitted by electronic mail.

Many word processors, including WordStar, end each line of file output to disk with a carriage return/line feed sequence. While WordStar accepts this as an input file, it prevents reformatting unless all extra carriage returns ('hard' ones) are removed. The second program strips these out, leaving a file that is easier to manipulate.

Both programs are Microsoft Basic for an IBM, but should work on any machine supporting disk I/O.

Hugh Glover

```
10 CLS
20 PRINT : PRINT
30 PRINT "This is designed to covert a  Wordstar printed file into an  ASCII"
40 PRINT "file that can be transmitted to another system.   All non-printing"
50 PRINT "characters are  stripped  from the  output except <cariage return>"
60 PRINT "and <line feed>.    The  source  should be a  file that  has been"
70 PRINT "'printed' to disk by Wordstar."
80 PRINT : PRINT
90       INPUT "Source file       "; FILE1$
100 OPEN FILE1$ FOR INPUT  AS #1
110       INPUT "Output file       "; FILE2$
120 OPEN FILE2$ FOR OUTPUT AS #2
130 IF NOT EOF(1) THEN LINE INPUT #1,A$ ELSE GOTO 230
140 C$=""
150 FOR N=11 TO LEN(A$)
160 B$=MID$(A$,N,1)
170 IF ASC(B$)<32 OR ASC(B$)>127 THEN B$=""
180 C$=C$+B$
190 NEXT N
200 PRINT C$
210 PRINT #2,C$
220 GOTO 130
230 PRINT "Conversion complete"
```

```
10 CLS
20 PRINT : PRINT
30 PRINT "This is designed to covert an ASCII text file into a Wordstar"
40 PRINT "format  file  with  paragraphs  that  can be  re-formed by ^B"
50 PRINT "The  contents  of the  output file are echoed to the  screen."
60 PRINT "Non-printing characters are shown by their ascii value within"
70 PRINT "angle brackets. Thus ^Z appears as < 26>."
80 PRINT : PRINT
90 INPUT "Source file       "; FILE1$
100 OPEN "R", #1, FILE1$,1
110 FIELD #1,1  AS A$
120 L=LOF(1)
130 INPUT "Output file       "; FILE2$
140 OPEN "R", #2, FILE2$,1
150 FIELD #2,1  AS D$
160 P1=0
170 GET #1 : P2=ASC(A$)
180 GET #1 : P3=ASC(A$)
190 GET #1 : P4=ASC(A$)
200 IF (P1<>13 AND P1<>10) AND P2=13 AND P3=10 AND (P4<>13 AND P4<>10) _
      THEN P2=141 : P2$=CHR$(141)
210 C$=CHR$(P1)
220 LSET D$=C$
230 PUT #2
240 IF ASC(C$)<32 OR ASC(C$)>127
      THEN PRINT "<"+STR$(ASC(C$))+">"; ELSE PRINT C$;
250 P1=P2 : P2=P3 : P3=P4
260 GET #1 : P4=ASC(A$)
270 IF LOC(1)<=L THEN GOTO 200
280 PRINT : PRINT : PRINT "Conversion complete"
```

AMSTRAD HEADER READER

This short program reads cassette file headers. Line 210 initialises the registers and calls CAS READ. 64 bytes are read in from the header, of which 27 contain data about the program on tape. The rest of the bytes are available for use by the programmer.

The program then displays the information about the progam on tape. Logical variable names help to explain how the data is stored. The program offers the option to continue and read another header, or stop.

James Marshallsea

```
10 REM
20 REM
30 REM
40 REM
50 REM
60 REM
70 REM
80 REM
90 REM
100 MODE 1:INK 1,5:INK 2,26
110 LOCATE 12,1:PRINT CHR$(24);" INSERT TAPE ";CHR$(24)
120 PRINT:PRINT TAB(18)"&":PRINT
130 PRINT TAB(12);CHR$(24);" PRESS  PLAY ";CHR$(24)
140 PRINT:PRINT TAB(16);"then":PRINT
150 PRINT:PRINT TAB(7);"Press ";CHR$(24);" any key ";CHR$(24);" to begin "
160 MEMORY 43890:RESTORE 210
170 FOR I=43891 TO 43902
180   READ D:POKE I,D
190 NEXT
200 CALL &BB18
210 DATA &21,&80,&12,&11,&00,&40,&3e,&2c,&cd,&a1,&bc,&c9
220 CALL 43891:CLS:PEN 2
230 LOCATE 10,1:PRINT CHR$(24);" HEAD 'X' ANALYSIS ";CHR$(24):PEN 1
240 T$=""
250 FOR I=4736 TO 4751
260   A=PEEK(I):IF A<32 THEN A=32
270   T$=T$+CHR$(A)
280 NEXT
290 Blo.Num=PEEK(4752)
300 Blo.Len=PEEK(4756)*256+PEEK(4755)
310 Pro.Lengh=PEEK(4761)*256+PEEK(4760)
320 Load.Add=PEEK(4758)*256+PEEK(4757)
330 Type=PEEK(4754)
340 Blocks=Pro.Lengh/2048
350 IF Blocks<>INT(Blocks) THEN Blocks=INT(Blocks)+1
360 Pro.Load.Add=Load.Add:B=Blo.Num
370 IF B>1 THEN Pro.Load.Add=Pro.Load.Add-2048:B=B-1:GOTO 370
380 Pro.End=Pro.Load.Add+Pro.Lengh
390 LOCATE 9,3:PRINT" NAME---------- ";T$
400 LOCATE 9,5:PRINT" TYPE---------- ";
410 IF Type=0 THEN PRINT"UNPROTECTED"
420 IF Type=1 THEN PRINT"PROTECTED"
430 IF Type=2 THEN PRINT"CODE"
440 IF Type=22 THEN PRINT"ASCII"
450 IF Type>2 AND Type <>22 THEN PRINT "UNKNOWN"
460 LOCATE 1,7:PRINT" CURRENT BLOCK NUMBER-";Blo.Num
470 LOCATE 1,9:PRINT" TOTAL BLOCKS IN FILE-";Blocks
480 LOCATE 1,11:PRINT" BLOCK LOAD ADDRESS---";Load.Add;"  &";HEX$(Load.Add)
490 LOCATE 1,13:PRINT" BLOCK LENGH-----------";Blo.Len
500 LOCATE 1,15:PRINT" PROGRAM LOAD ADDRESS-";Pro.Load.Add;"  &";HEX$(Pro.Load.A
dd)
510 LOCATE 1,17:PRINT" PROGRAM END ADDRESS--";Pro.End;"  &";HEX$(Pro.End)
520 LOCATE 1,19:PRINT" PROGRAM LENGH---------";Pro.Lengh;"  &";HEX$(Pro.Lengh)
530 PEN 2:PRINT:PRINT
540 PRINT" Press ( P ) to playin a tape":PRINT" Press ( S ) to stop":PEN 1
550 K$=UPPER$(INKEY$):IF K$="" THEN 550
560 IF K$="P" THEN RUN
570 IF K$="S" THEN CLS:CALL &BC02:END
580 PRINT CHR$(7);:GOTO 550
```

COMMODORE 64 REGISTER DISPLAY

This is a utility designed to help machine code programmers. While developing a machine code program, the states of the internal registers often need to be known to determine if the program is working correctly or not. This machine code utility detects a BRK instruction and passes control to the rest of the routine; the start and address is given in locations \$0316 to \$0317.

To display the registers when running a machine code program, insert a BRK command at the desired point, followed by a NOP command. To use the routine, type in the Basic program and save it. Now run it and type SYS 32768: the READY message will appear and the routine is ready to use. It is stored in locations \$8000 to \$81AD.

I Redmore

```
10 PRINT"□":SA=32768:L=429
20 N=0:READ D$:IF D$="*" THEN 80
25 PRINT"□□■ DATA BYTES LEFT : ";L
30 FOR X=1 TO 2
40 T=ASC(MID$(D$,X,1))
50 Y=T-48+(T>57)*7
```

```
60 N=N*16+Y:NEXT X
70 POKE SA,N:SA=SA+1:L=L-1:GOTO 20
80 PRINT"USE 'SYS 32768' TO ENTER ROUTINE"
85 PRINT"USE 'SYS 33185' TO EXIT ROUTINE"
90 END
100 DATA 78,A9,0D,8D,16,03,A9,80,8D,17
110 DATA 03,58,60,68,8D,AB,02,68,8D,AA
120 DATA 02,68,8D,A9,02,68,8D,AC,02,68
130 DATA 8D,A8,02,68,8D,A7,02,48,AD,A8
140 DATA 02,48,AD,AC,02,48,A2,00,BD,A9
150 DATA 02,48,E8,E0,03,D0,F7,A2,00,18
160 DATA 0E,AC,02,A9,00,90,02,A9,01,9D
170 DATA AD,02,E8,E0,08,D0,EE,A9,00,8D
180 DATA 20,D0,8D,21,D0,A9,03,8D,86,02
190 DATA A0,00,B9,28,81,20,D2,FF,C8,C0
200 DATA 50,D0,F5,18,A2,03,A0,00,20,F0
210 DATA FF,A2,03,A9,20,20,D2,FF,CA,D0
220 DATA F8,A9,07,8D,86,02,A0,00,B9,A7
230 DATA 02,29,F0,20,23,81,20,14,81,B9
240 DATA A7,02,29,0F,20,14,81,C8,C0,02
250 DATA D0,E8,18,A2,03,A0,0B,20,F0,FF
260 DATA A0,00,B9,A9,02,29,F0,20,23,81
270 DATA 20,14,81,B9,A9,02,29,0F,20,14
280 DATA 81,A9,20,20,D2,FF,C8,C0,03,D0
290 DATA E3,18,A2,03,A0,16,20,F0,FF,A0
300 DATA 00,B9,AD,02,20,14,81,A9,20,20
310 DATA D2,FF,C8,C0,02,D0,F0,A9,2D,20
320 DATA D2,FF,A9,20,20,D2,FF,A0,00,B9
330 DATA B0,02,20,14,81,A9,20,20,D2,FF
340 DATA C8,C0,05,D0,F0,18,A2,0A,A0,00
350 DATA 20,F0,FF,A0,00,B9,79,81,20,D2
360 DATA FF,C8,C0,28,D0,F5,20,E4,FF,C9
370 DATA 20,D0,F9,4C,BC,FE,C9,0A,30,05
380 DATA 69,36,4C,1F,81,69,30,20,D2,FF
390 DATA 60,4A,4A,4A,4A,60,93,20,20,50
400 DATA 52,4F,47,52,41,4D,20,20,52,45
410 DATA 47,49,53,54,45,52,53,20,20,53
420 DATA 54,41,54,55,53,20,52,45,47,49
430 DATA 53,54,45,52,20,20,20,20,20,43
440 DATA 4F,55,4E,54,45,52,20,20,41,2E
450 DATA 20,58,2E,20,59,2E,20,20,20,4E
460 DATA 20,56,20,2D,20,42,20,44,20,49
470 DATA 20,5A,20,43,20,20,20,20,2E,2E
480 DATA 2E,50,52,45,53,53,20,53,50,41
490 DATA 43,45,20,54,4F,20,52,45,54,55
500 DATA 52,4E,20,54,4F,20,50,52,4F,47
510 DATA 52,41,4D,2E,2E,2E,20,78,A9,66
520 DATA 8D,16,03,A9,FE,8D,17,03,58,60
530 DATA *
```

IBM PC SWITCHING

This routine checks to see if a colour graphics board is present. If one is, it then switches to colour mode directly from Basic, without needing to quit to DOS and use the MODE CO command. The alterations to the routine necessary to switch to monochrome mode are also shown. Programmers who wish to use the method in non-Basic programs should be able to get the necessary information from the program.
Mike Curtis

```
10 GOSUB 1000 ' Check for Color/Graphics board
20 IF COL=0 THEN PRINT "No Color/Graphics board present":END
30 GOSUB 2000 ' Switch to colour monitor
40 REM Rest of program
50        :
60        :
70        :
1000 REM Check for Color/Graphics board
1010 SCREEN 0,0,0
1020 DEF SEG=&HB800
1030 SUM=0
1040 FOR I=2000 TO 2010 STEP 2
1050 POKE I,170
1060 SUM=SUM+PEEK(I)
1070 NEXT I
1080 IF SUM<>1020 THEN COL=0 ' No Color/Graphics board found
1090 IF SUM=1020 THEN COL=1  ' Color/Graphics board present
1100 RETURN
2000 REM Switch to colour monitor
2010 DEF SEG=0
2020 POKE 1040,157
2030 SCREEN 0
2040 WIDTH 40
2050 LOCATE ,,7,7
2060 RETURN

To switch to a monochrome monitor alter lines

1020 DEF SEG=&HB000
1040 FOR I=4000 TO 4010 STEP 2
2020 POKE 1040,189
2040 WIDTH 80
2050 LOCATE ,,10,11

If this does not work on your IBM compatible then to find the correct
values to POKE into location 1040 :

Monochrome monitor                    Color/Graphics

In DOS type                           In DOS type

MODE MO                               MODE CO
BASIC                                 BASIC

When in BASIC                         When in BASIC

DEF SEG=&HB000                        DEF SEG=&HB800
PRINT PEEK(1040)                      PRINT PEEK(1040)

Replace the values 189 and 157 with the 2 given values respectivly.
```

BBC SINGLE-STEP LISTINGS

This short machine code routine for the BBC Micro allows a program to be listed in a similar way to page mode, but holds output after every carriage return until a key is pressed.

When entered and run, the routine can be switched on with the command *LINE and off with the command *CODE. Lines 50 to 100 decide whether or not to wait for a key press, line 100 uses OSWRCH to wait for a key to be pressed. Lines 120 and 130 return to normal operation. Lines 140 to 160 deal with the *CODE and *LINE commands, and lines 180 to 210 adjust the vectors used by OS to ensure that the routine is used. The routine is stored in an unused area of zero page, but can be moved by altering the value of P% in line 30.
Allan Kelly

```
10 addr = ?&20E+(?&20F*256)
20 FOR A=0 TO 3 STEP 3
30 P%=&70
40 [ OPT A
50 .start PHA
60 LDA st
70 BEQ end
80 PLA:PHA
90 CMP£&D
100 BNE end
110 JSR&FFE0
120 .end PLA
130 JMP addr
140 .line STA st
150 RTS
160 .st BRK
170 ]NEXT
180 ?&200=line MOD 256
190 ?&201=line DIV 256
200 ?&20E=start MOD 256
210 ?&20F=start DIV 256
```

APRICOT MICROSCREEN LEDS

The microscreen LEDs on an Apricot PC or Xi can be switched on and off from a Basic program using the escape sequence ESC/n, where n is a number from 0 to 63. The format of the statement is: PRINT CHR$(27)+"/"+CHR$(n). If n=0 all the LEDs are switched off, while n=63 will switch them all on. The variations in between are based on binary bit patterns and can be worked out by creating a pattern. Assign each LED to a bit in order, and set it to 1 if you want the LED on and 0 if you want it off. The binary number thus created should be converted to decimal and this will give the desired result.

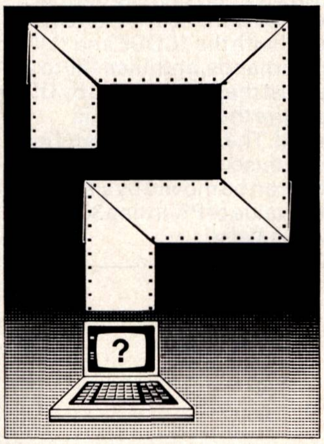
This method is fine for a Basic program. If you want the same effect under MS-DOS (say, in conjunction with the MISCREEN KEY) you can use the MS-DOS command TYPE followed by the name of a file containing two-digit hexadecimal codes. If the hex codes include the ESCAPE code (27 in decimal, 1B in hex), followed by the code for the backslash character (47 in decimal, 2F in hex), followed by a number between 0 and 63 (0 and 3F in hex), then the result will be the same as in the Basic command above. Other escape sequences can be handled by MS-DOS in a similar way; for example, 1B45 will clear the screen.

To create a hex file as above, use the outline routine. Before running it, write down the exact sequence of hex codes you want to use. Do not leave spaces or other separators between the codes. The last code in the sequence must always be 1A as this is treated as an end-of-file marker. Everything in a file after a 1A will be ignored, so it must occur in one place only — at the end.
Alec Wardrop

```
*********************************************
100 REM H$ - INPUT STRING REPRESENTING HEX
110 REM H$ - MUST BE TERMINATED BY 1A (IN HEX)
120 REM J$/J% - EVALUATES H$ TWO AT A TIME
130 C$="":REM C$ - TO BE A STRING OF HEX CODES
140 INPUT"FILENAME";F$:
150 INPUT"HEX-STRING";H$
160 J$="&H"+LEFT$(H$,2)
170 J%=VAL(J$)
180 C$=C$+CHR$(J%)
190 H%=LEN(H$):H$=RIGHT$(H$,H%-2)
200 H%=H%-2
210 IF H%=0 THEN GOTO 220 ELSE GOTO 160
220 OPEN"O",1,F$
230 PRINT£1,C$
240 CLOSE£1
*********************************************
```

COMPUTER ANSWERS

Simon Goodwin takes his toolkit to your problems. The address to write to is Computer Answers, PCW, 32-34 Broadwick Street, London W1A 2HG.



Perfect pitch

I would like to be able to change the pitch on the Oki Microline 80 printer when I use it with Easyscript and a Commodore 64. I have tried GS RS US in conjuction with an escape code, but with no success.

If I switch the printer on and off during print, it changes pitch from 5 to 10.

There is no problem with the printer in Basic, when PRINT CHR$ changes pitch.

J McForland, Wendover, Bucks

It has been three years since I last used the Microline 80 so I've forgotten the exact codes required, but you should be able to use the same codes in Easyscript as you do in Basic. The printer will always revert to its 'default' pitch — 10 characters per inch — when you turn it off and on, as it has no permanent memory for the last pitch used. You can re-select a given pitch by printing the control codes in your printer manual. This should work perfectly from within Easyscript if you use the correct technique.

The trick is explained on pages 8-10 of the Reference Section of the *Easyscript User Guide*. There are two different techniques, depending upon whether the signal you wish to send is a control code (a single character with an arbitrary ASCII value) or an escape sequence (CHR$(27) followed by one or more ASCII values).

You only need send one control code to change the pitch of the Microline 80. If we suppose that the effect you want is given by CHR$(15) in Basic, you achieve the same effect by defining a special character (section 8.12.11.2 of the manual) with that code. To make special character 2 correspond to CHR$(15), you put 2=15 into a format statement.

From this point onwards you can insert a CHR$(15) into your text by pressing F1 and 2. A reverse-video '2' will appear at the point where the CHR$(15) will be sent. Bear in mind that the word processor does not take control codes into account when formatting (it doesn't know enough about printers), so you will probably need to adjust the margins to keep text in a mixture of styles, neatly formatted.

You can set up 10 different control codes by substituting digits from 0 to 9 in place of '2' in the above example, and entering appropriate ASCII values on the other side of the equals sign. This should be enough to bring all the features of the Microline 80 under control, without using the more complicated Escape Sequence instructions in the next section of the (rather confusing) manual.

Beefing up the Beeb

I have been told that it is possible to add more RAM to the BBC Model B by way of a paged RAM system.

Is this true, and what will be the proper specification for such auxiliary RAM boards or paged RAM boards?

Where can they be bought and how are they fitted?

What is the name and address of the BBC Computer Users' Club and its magazine?

Finn Olsen, Drammen, Norway

You can expand the memory of the BBC Model B by fitting 'sideways' memory — the memory appears at the addresses normally used by add-on ROMs, and the mechanism used to alternate between ROMs is persuaded to switch between 16k 'pages' of RAM instead. Access to the extra RAM is slightly slower than to the normal 32k, due to the need for switching.

The memory is commonly used to hold the display information (which can require up to 20k on the BBC Micro) so that all of the standard 32k can be used for programs and data. In practice a few kbytes are used by the Beeb's operating system, but you do gain all the space previously used for the screen picture. This is especially useful if you use the Beeb's 80-column display. Software supplied with the memory makes the computer automatically use sideways RAM in this way.

A popular make of sideways RAM is the 20k Aries B20, from Aries Computers of Milton Road, Cambridge CB4 4BH. Twillstar Computers, of 17 Regina Road, Southall, Middlesex UB2 5PL, markets a similar product called the Raven 20.

Watford Electronics, of 33 Cardiff Road, Watford, offers a 32k expansion which works in much the same way — the extra 12k can be used as a printer buffer, so you can carry on using the computer while documents are being printed. Solidisk Technology, of 17 Sweyne Avenue, Southend on Sea, Essex, produces a range of expansion cards offering up to 256k of sideways RAM.

All these boards plug into ROM or processor sockets on the BBC Micro circuit board and are supplied with fitting instructions. If you wish to use the memory with specific software or add-on hardware, you should contact the suppliers to make sure that their memory is compatible — some programs and devices are not compatible with sideways RAM.

In general, these expansions are only useful if you have software to suit them. You can't run Basic programs in sideways RAM, for example, so if your code needs more than about 28k you'll probably have to buy a second processor — these come with 64k of memory, of which about 46k is available to Basic.

There are dozens of BBC Micro user clubs, catering for all sorts of specialised interest. The largest is Beebug, which can be contacted via PO Box 109, High Wycombe, Bucks. The club magazine, also called Beebug, is published 10 times a year.

The right connection

Is there any way I can download data recorded on a Psion Organiser into a Commodore 64? The data I have in mind will need to be loaded into Superbase for processing and subsequent printing out.

Could you tell me how I go about it?

SG Norsted, Woburn Sands, Milton Keynes

Your best bet is to connect the machines using RS232 interfaces. This can be a tricky process, so you should consider retyping the data unless you really need to transfer information between the computers on a regular basis. Psion can supply an interface for the Organiser.

The Commodore 64 has a built-in serial interface but this does not use RS232 protocol, so you need a converter to get the machines talking to one another. Be wary when purchasing an adaptor for the Commodore 64, as the 'reception' side of RS232 is generally the trickiest to get right: some cheap adaptors are really only designed to transmit information to printers. Any RS232 interface capable of driving a modem should work with the Organiser.

You may need to fiddle around a little to get the machines talking. Make sure that both devices are using the same speed — start with a slow speed, like 300 baud, and try to increase this when communication is under way.

Both machines should use the same 'protocol' — this is the number of bits per character, parity, and the number of start and stop bits used to delimit each character. As long as you use at least seven data bits, and the same delimiters and parity at both ends of the line, all should be well. A good initial setting is eight bits, no parity, one start bit and two

stop bits.

If things don't work at first, this may be because both computers are talking at once. Serial interfaces generally use a four-wire 'handshaking' system. Two wires convey data in each direction, and the other two indicate that each machine is ready to receive data.

The RS232 system is bi-directional, but the naming convention assumes that one device is 'in charge' of the conversation. When you connect a computer to a peripheral such as a printer, this is not generally a problem, as most peripherals let the computer take charge. But when you connect two computers you run the risk that both will try to talk at once — in effect, they will both send data on the 'data out' line, when the 'slave' machine should transmit on the 'data in' wire, so that the names make sense at the 'master' end.

If this is your problem, you will need to reverse the connections at one end of the cable. You may have to consult your equipment supplier to find out how to do this — some interfaces (such as the one on the BBC Micro) use a 'reversible' connector, so that you can swap the wires by turning over the plug.

Typepro Ltd supplies adaptors called 'gender changers', which save you the hassle of rewiring cables. It sells a suitable RS232 interface for the Commodore 64, and is willing to make 'custom cables' to order. Contact Typepro on (0223) 322394, or alternatively Psion on (01) 723 6919.

Another connection

I have a Sharp MZ80K and an Amstrad CPC464. I would like to get them to 'talk' to each other without affecting any other Amstrad expansions — printer, disk drive, speech synthesiser, and so on.

I am not planning to expand the Sharp any further.
G Vine, Stockport, Cheshire

In theory it would be possible to interface the computers via their cassette ports, but machine code software would also be needed on one or other machine so that the 'alien' protocol could be decoded. Unless a reader who has cracked the problem writes in, I would suggest that you avoid this alternative and opt, once again, for a so-called 'standard' RS323 link.

You will need an RS232 interface for both computers. An interface for the Sharp is available from Peterson Electronics (0307) 62591. A number of firms produce RS232 interfaces for the Amstrad, but some of these interfere with future expansion of the system. By the time you read this, Amstrad should have produced its 'official' RS232 unit. I'd recommend this in preference to the others, as it should be fully compatible and widely available — it also adds an extra 32 commands to Amstrad Basic.

Computer tutors

I have an 18-year-old daughter who is educationally handicapped and a very slow learner. I have heard that computer teaching programs are commercially available. Where can I find a list of these?

I have an eight-month-old Dragon micro but do not know of any suitable programs, and thus realise that it may be necessary to purchase another micro. What is the best way of buying a second-hand computer, avoiding the pitfalls, bearing in mind that I am not technically minded?
S Grattage, Wednesbury, West Midlands

It is impossible to give specific advice about educational software without knowing the details of your daughter's disability. You will find advertisements for educational software for the Dragon in specialist magazines such as *Dragon User*, but (as you say) there is not much about. Touchmaster used to offer some excellent educational programs for the Dragon, in conjunction with its graphics tablet, but it seems to have ceased trading.

If you decide to change machines, you should bear in mind that your Dragon will not fetch much on the second-hand market. The Acorn Electron and the Sinclair Spectrum are probably the best machines to replace it with, as there is a good deal of educational software available for both.

The main advantage of the Spectrum is the sheer size of its software catalogue, which includes excellent programs for almost every conceivable purpose. The Electron scores on the quality of its keyboard and built-in programming facilities, but it was never a best-seller.

If you shop around you can buy these machines, new, for under £100. At that price it is probably not worth buying a second-hand machine — unless you can find reliable technical advice, the element of risk involved will probably outweigh the price-saving.

Educational software for the Spectrum is plentiful and cheap. Electron software is a little harder to obtain, but many packages for the BBC Micro, a recent favourite with schools, will also run on the Electron. Prices are a little higher, but there is less rubbish. In both cases, you should be able to obtain software from large stores.

Many 'entertainment' programs have a great deal of educational potential. You may find that simple adventure games and simulations have more educational value than 'drill-and-practice' routines.

The end of the line

My system consists of a Sinclair ZX Spectrum with Interface 1 and microdrives, connected to a Juki 6100 printer with a serial card.

Word processing with Tasword 2 works well, but I am unable to obtain satisfactory program listings. The Juki has a maximum printing width of 11 inches, or 110 characters, using my daisywheel.

If a program line consists of more than 110 characters, the printer does not generate a line feed until the end of the program line. This means that every character after number 110 is printed at the same print position. Have you any suggestions?
George Jessen, Sunderland

You're not the only one with this problem — I ran into the same snag when using the Juki with a Dragon computer, although in that case I was able to solve it by telling the computer to insert a line feed after a certain number of characters. POKE 155,N sets the line width to N, but this trick only works on the Dragon and Tandy Colour Computer.

I don't think the Juki is clever enough to wrap lines for you, so you will need to take some action at the Spectrum end of the link. If you were using a Kempston Centronics printer interface you could impose a fixed line-length with a POKE, as on the Dragon, but this only works with interfacing software loaded from cassette. It would be quite expensive to put Centronics interfaces at both ends of your printer cable.

Another option is to alter your programs so that they don't contain such long lines. This can largely be done automatically. A program called Supercode 3 (from CP Software, (0532) 694504), contains a neat utility which breaks down Basic programs so that each line contains only one statement. This may leave a few long PRINT statements to be edited manually. Supercode contains more than 100 other 'utility' routines, and runs happily from microdrive.

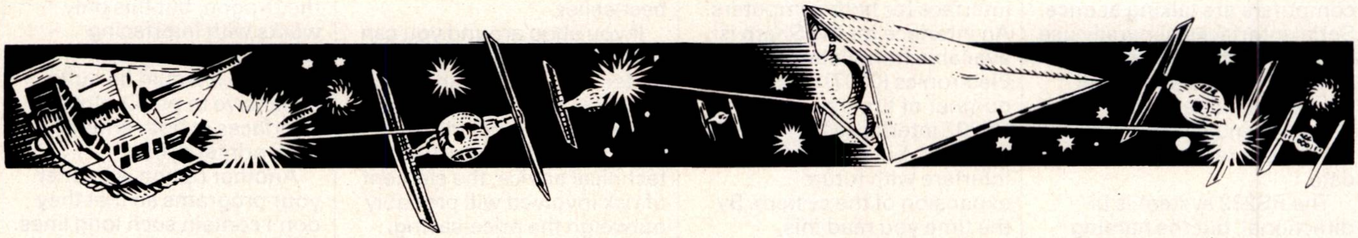
If you are prepared to do some programming yourself, you could get around the problem by LISTing your Basic to a microdrive file. Read the lines back one by one into a string variable, and print them to the RS232 piecemeal. Your program can insert line feeds after each section of a line, but this process will not be very fast.

Amstrad literature

A few months ago I purchased an Amstrad CPC464. I would like to know if there is a book which explains the machine's capabilities better than the manual.
Ali Imran, Lahore, Pakistan

I don't know of any 'easy' guide to the Amstrad which is worth buying — this is probably because the manual supplied with the machine is quite good from this point of view, at least by the standards of other micro manuals.

The *Concise Basic Specification* is heavy going, but a good source of information about the inner workings of the machine's Locomotive Basic. The *CPC464 Firmware Manual* is rather better reading. It contains general details of the system which would be of use to a machine code programmer. Both are available from Amstrad at a rather hefty price of £20 each. If you want to delve into the intricacies of the disk system, the *DDI-1 Firmware Manual* should be your guide. It costs £10, again from Amstrad at 169 King's Road, Brentwood, Essex. END



Frankie Goes to Hollywood and so does Stephen Applebaum, as he finds pleasure and relaxation in this month's dip into the games goodies bag. He also finds ghosts and goes on the run with Monty, courtesy of the Commodore 64, Atari, Spectrum and Amstrad.

Relax

Title: Frankie Goes to Hollywood
Computer: Commodore 64, Spectrum 48k
Supplier: Ocean
Format: Cassette
Price: £9.95

Love them or hate them, you can't ignore Frankie Goes To Hollywood. If you somehow missed the publicity churned out by their massive hype machine, then undoubtedly you must have read at least one news article outlining either the band's off-the-wall stage antics, controversial lyrics, debauched lifestyle, or outrageous videos.

Since those early days, things have been quiet on the Frankie front. There has been no new record, comparatively minimal news coverage, and thankfully few 'Frankie Says . . .' T-shirts paraded about the streets. Now, for better or for worse, the sleeper has awakened, and the well-worn, hedonistic refrains of 'Relex' can once again be heard, albeit from a computer. With the help of Ocean/Denton Designs, Frankie Goes

To Hollywood's wry humour and grandiose synth-pop have been immortalised in one of the classiest games for a long time.

In true Frankie tradition, the game revolves around the quest to become a complete person through the pursuit of pleasure. This takes you on an epic journey starting from the meticulously-drawn drabness of Mundanesville and ending with the Ultimate Experience, found only at the heart of the Pleasure Dome.

Mundanesville is a sleepy, almost comotose housing estate devoid of excitement and originality; a kind of Milton Keynes on Valium (like the surroundings, you begin the game lack-lustre and bereft of personality). Hidden within this framework of ennui is a selection of innocuous-looking items which, when collected, add substance to your character.

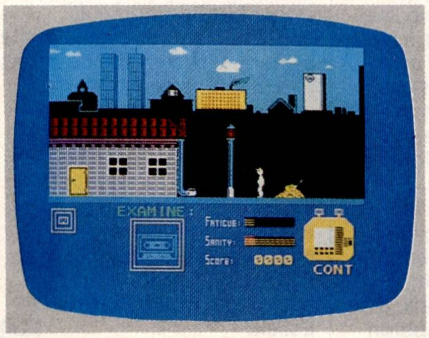
As any Frankie fan will know, a personality can be represented by the equation (Pleasure + War + Love+ Faith) × Frankie = BANG. If, like me, you're not attuned to the Frankie school of philosophy, all you need to know is that each of the four factors on the left-hand side of the equation are represented in the game by symbols as diverse as sperm, bombs, hearts and crosses respectively; these are the objects which must be collected in order to increase your personality rating.

While searching Mundanesville, you will discover several ways of entering the Pleasure Dome, ranging from the obvious to the surreal. (I'd like to mention them, but that would be giving too much away. All I can say is that there is more to the videos than meets the eye, and pictures mirror pursuits of pleasure found elsewhere.)

Inside the Pleasure Dome, there are various arcade games which must be completed if you are to get anywhere near the Ultimate Experience. On the whole these require quick reflexes, although some exercise the old grey matter rather than the wrist.

Of all 10 arcade games, my favourite is Flower Power. If the name suggests the hippy era, just wait until you play it. I guarantee that this game will soothe your karma and have you lighting incense in a rush of calm.

Of all Ocean's programs, Frankie Goes To Hollywood is its most technically perfect. The icon graphics and playing screens which literally unfold to present a new scene are stunning, as is the accompanying music — especially in Flower Power. Some scenarios, such has Talking Heads which has Reagan and Ghorbachev spitting at each other across the Iron Curtain, are rather controversial, but Frankie has built its whole reputation on being polemic, so it's not suprising that the game has its unsavoury elements.



The right spirit

Title: Just the Spirit
Computer: Spectrum 48k
Supplier: The Edge
Format: Cassette
Price: £7.95

Ever since the arrival of Ghostbusters, games based on the supernatural have been appearing on the market quicker than you can say Doris Stokes. The latest to materialise for the Spectrum is The Edge's Just The Spirit, a game which takes ghosthunting into the 1990s and gives adventuring a new and novel twist.

Like Ghostbusters, the idea behind Just The Spirit is to rid the streets of errant ghouls, but unfortunately this time the task is not as simple as driving round easily accessible locations and bagging a ghoul. The streets themselves have become a dangerous place for the unwary ghosthunter. Rampant

grannies out for young blood block you path, as do break-dancers and dogs, among others. If you keep your wits about you, the task isn't too great.

Just The Spirit is a graphics adventure with a difference. Instead of the player having to type in commands, The Edge has designed the game so that each Spectrum key represents a different command.

Rather than typing in EAT, for example, you simply press a key. Although this saves time and a lot of thought about what commands you can and can't use, it does mean you have to keep looking for the right key.

A sheet of paper with the keyboard layout and commands printed on it has been provided, although it isn't possible to use it as a keyboard overlay.

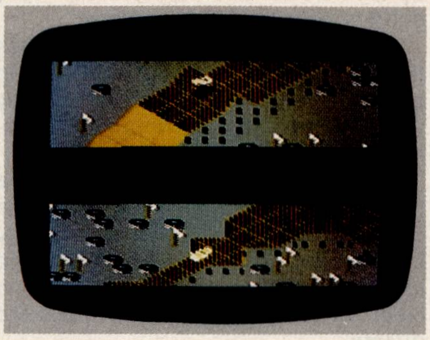
While the game is in progress, the screen displays a backdrop of skyscrapers and shops with your animated character shown in the foreground. He can be moved from left to right, and in an out of buildings. On your travels around the city, you'll come across various objects that will help you.

One of the most useful is a laser, but it can only be used in conjunction with a power pack. The fact that you often have to connect two objects together to make one of them function is a major feature of the game. The Edge tells me that there is a QL to be found, which can be linked up to a monitor. The result, I am told, is quite surprising. Could it actually work?

Like Monty On The Run, also reviewed here, Just The Spirit has a nice sense of humour running throughout. Some of it is really devilish, especially when the Sinclair logo suddenly appears, making you think that the game has crashed.

Just The Spirit is a nice little game which requires a lot of patience: there are lots of puzzles to be solved and aliens to be zapped.

I have my doubts about it appealing to long-standing adventure fans, as the vocabulary is limited to what is on the keyboard, however I'm sure that it will appeal to both players of arcade games and those who want to get into adventures but aren't sure which one to buy.



Death race

Title: Racing Destruction Set
Computer: Commodore 64, Atari
Supplier: Ariolasoft
Format: Disk, cassette
Price: £14.95, £12.95 (Commodore prices)

Motor madness, murder, mayhem — just some of the salient features of Racing Destruction Set, another Ariolasoft blockbuster. Unlike most racing programs, the emphasis in this game is upon totally obliterating the opposition, rather than simply racing around a circuit. There is an element of the latter, although this is overshadowed by the war of attrition that rages between the cars as they slip and slide around a variety of treacherous tracks.

Like many of Ariolasoft's games (Mail Order Monsters for one — see the review here), Racing Destruction Set is rather complex. Before diving headlong into a race, each player (there can be one or two) must select a vehicle. There are 10 basic models on the game disk, and all can be customised. To each of these can be added a variety of different weapons, as well as a change of engine size and tyres. As more armour is added the car becomes heavier and slower, so you have to weigh up how much protection you want against speed; this in turn is dependent on whether you are purely racing or playing the destructive option.

Selecting and customising a car is just part of the pre-race ritual. There are also 50 different tracks to ponder over, plus four backgrounds and 14 gravity settings to hot up the action.

Racing Destruction Set makes extensive use of the Commodore disk drive and is slow as a result. When a new track is loaded, the program first scans the elements making up the circuit before converting the information about the track into the form it needs for the race. If the track is one of the more complex layouts, this process can take several minutes.

Some of the tracks are exceedingly difficult in their original form, but for those who feel adventurous, extra hazards such as ice or dirt can be inclued using a special track editor. Not only can extra bits be added to existing tracks, but new ones can be constructed from scratch. The process is simple but time-consuming, a feature which many Commodore programs suffer from.

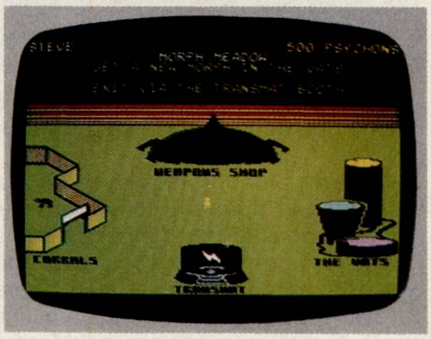
In play the screen is of the split-screen variety, with one player's car being shown at the top while the other is at the bottom. For much of the game the two cars are separated by a distance too large to display them both in the same box, but when they're side by side, both are shown in the same area.

Racing Destruction Set is a stunning game with a great deal of originality. If you like racing games buy it; if not, buy it anyway — you're sure to be converted by this one. I was.

Rent-a-morph

Title: Mail Order Monsters
Computer: Commodore 64, Atari
Supplier: Ariolasoft
Format: Disk, cassette
Price: £14.95, £12.95 (Commodore prices)

Have you ever wanted a monster that'll frighten your granny or eat the cat (or



vice versa)? If so, Mail Order Monsters could be just what you're looking for. Within the pages of its catalogue are printed a host of obsequious and obedient Mail Order Psychon Heroes (morphs), all ready to take up the cause in your name. No task is too great for a morph, but it should be remembered when choosing one that for them, life is little more than an arena of combat where the Olympian spirit prevails and kudos is the only prize.

Mail Order Monsters is situated in the aptly-named Monster Meadow. Here, scattered about the landscape, are the corporation's vat, weapons shop, corral and transmat booth. Would-be morph owners' first port of call is the vat. Contained within its metal walls is a vast range of morphs, all priced according to their physical traits. Bottom of the range is the humble hominid, while people with psychons to burn might just be able to afford the extravagance of the tyrannosauras rex.

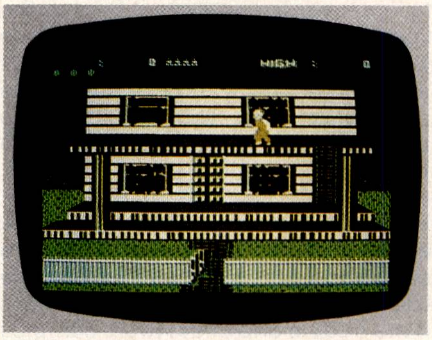
You lead your newly acquired monster into the weapons shop where, for a few psychons more, he can be equipped for battle. Then it's off to the transmat booth which transports both you and your beast to the battleworld. Eight battleworlds are contained on the game disk, along with different sets of rules and three scenarios.

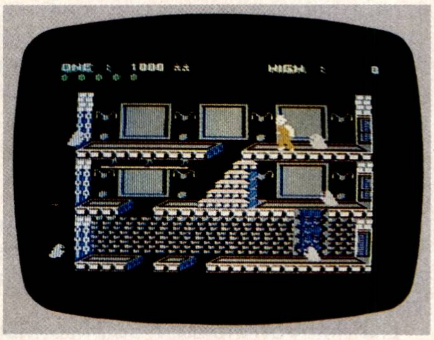
Down in the battleworld, morphs become embroiled in combat with other morphs. Only through skillful

joystick control and a well-stocked armoury can you hope to save your creature from becoming just another contender.

Rented morphs victorious in battle cannot be kept for another day. But those involved at tournament level can be returned to the vats for healing or an upgrade from where they can then be penned in a corral, thus saving them to disk.

Mail Order Monsters is an original game with more than a little humour. My only gripe is regarding the amount of disk changing that is required between loading an old monster and starting a game. This, coupled with the extruciatingly slow speed of the Commodore disk drive, makes playing Mail Order Monsters a very time-consuming but enjoyable, pastime.





Ghostly manners at the manor

Title: Ghost Chaser
Computer: Commodore 64, Atari
Supplier: US Gold
Format: Cassette, disk
Price: £9.95, £14.95

Ghost Chaser, one of the programs in US Gold's latest bumper batch of new releases, is yet another platforms-and-ladders game. Although far from original, Ghost Chaser combines a pleasant sense of humour with some simple but nice graphics to overcome what is an otherwise well-worn scenario.

All the game's action takes place in Fairport Manor, a great, deserted edifice which is overrun with a multitude of less than scrupulous spirits. Only one man can save the building from absolute damnation and that's Harry, the local ghost chaser.

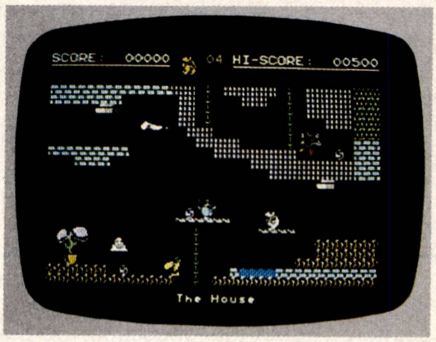
You take the role of Harry, guiding him in and out of the rooms, ridding each of its unwanted visitors. Exorcising the spooks, however, is a tricky business.

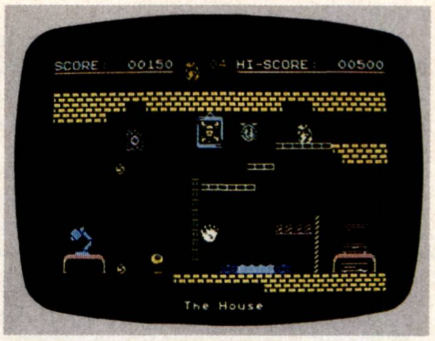
Only by hitting a ghost with a well-aimed glob of ectoplasm can you hope to get rid of it. If you miss, or aren't quick enough, the wraith passes straight through you, sending shivers up and down your spine. Too many shivers, and it's goodbye Harry.

At the start of the game Harry only has three globs of ectoplasm, but he can pick up more as he fumbles his way through the manor, jumping and ducking the ghosts as he goes.

While passing through several of the rooms, Harry has to pick up a key or he can't progress through the house. Only by collecting all the keys can he descend into the very bowels of the house and clear all 16 rooms of their unwanted guests.

Ghost Chaser is not one of US Gold's best releases, but it is a very addictive game which I found most challenging. I wouldn't recommend it to players who like to speedily zap away at aliens: it will please those who like their arcade action to be a bit more leisurely.





Music Monty, please

Title: Monty On The Run
Computer: Commodore 64, Spectrum 48k, Amstrad
Supplier: Gremlin Graphics
Format: Disk, cassette
Price: £11,95, £7,95, £9.95

Monty Mole, the overweight star of countless Gremlin Graphics games, has returned once more in what is his greatest challenge yet. In Monty On The Run our hero, who has successfully escaped from prison, must make his way to freedom through many hideouts and secret locations. To complete the journey, Monty has been given a freedom kit consisting of 20 items, only five of which are of any use. The idea therefore, is to help Monty search for the correct five items and finally get him on his way to safe territory.

As Monty blunders his way through a multitude of different screens, he is constantly beset with danger. In some rooms this merely means the odd chasm to somersault over, but others contain small, malevolent beasties which threaten to bounce on Monty, instantly despatching him to rodent heaven. Some of the nasties will be instantly recognisable to fans of Gremlin Graphics' other games: for instance, in several of the rooms, different-coloured things on springs (see October's Screenplay) can be seen hopping around.

Throughout the game there are numerous graphic gags which work in most cases, although someone should have told the programmers that C5 jokes are by now, rather passé.

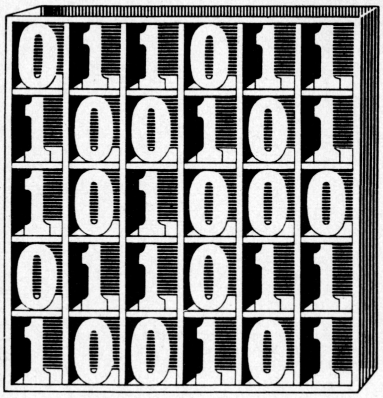
One of the best jokes that I stumbled upon, although I by no means found even half of the program's numerous screens, was one where two lifts tempt the player to use them. Only one works properly however, the other rising to its full height before falling to the ground, splattering Monty all over the shop (tasteful, huh?).

Actually playing Monty On The Run is only half the fun. What really makes it special is the stupendous backing music that titilates your tympanic membrane during and after the arduous journey.

The music, which seems endless but as far as I could tell, without repetition, could have been performed by Jean Michel Jarre, it's really that good. Not only is there a nifty keyboard playing throughout, but also various synthesised drum sounds which add to its already considerable depth. If that isn't enough, a different, equally brilliant piece plays when the high-scores table is displayed. What more could you want?

On the surface, Monty On The Run is just another platforms-and-ladders program. In play, however, it has a wit and charm that transcend most games of its genre. It deserves to be another hit for Gremlin Graphics, and I have no doubt that it will be. END

SUBSET



David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to SubSet, PCW, *32-34 Broadwick Street, London W1A 2HG.*

68000 SERIES FLOATING POINT

The nine Datasheets this month are all from Terry Browning of Wells, and form a floating-point arithmetic suite which should be assembled in the order given. Asterisks mark displacements to destinations in other Datasheets inside the suite.

Terry was inspired to this task by the Z80 floating-point suite in March but, due to the differences between the Z80 and the 68000, his suite is not a straight translation of the Z80 format.

The 32-bit internal architecture of the 68000 series processors means that a floating-point number with 24-bit mantissa and 8-bit exponent can be accommodated in a single data register, but no 68000 operations can be performed on three-byte values without affecting the fourth byte so the exponent of each number has to be transferred to a second register for processing. As byte operations always use bits 7-0, the exponent is stored as the lowest-order byte in the packed number.

With the exponent moved to another register, 32-bits are available for dealing with overflow and rounding bits that result from operations on the 24-bit mantissa. 68000 bits and byte manipulation can be a complex subject, which is why I have included some useful hints on how to do it in my new book, *68000 Machine Code Programming*.

ANY ANSWERS?

Terry would like to know why the square root algorithm works — this is a general problem. Many of the algorithms that have appeared in SubSet are not self-explanatory: we know they work and can be used on various precisions and formats, but have not discovered why. Any short and clear explanations or references will be welcome.

Additions to the floating-point suite will also be helpful. Terry is primarily interested in routines to convert between binary and decimal floating-point formats for input and output so that he can convert the algorithms to Forth.

DATASHEET 1

```
:==========================================================
:= ENTRY        Expand f.p. input numbers to working format.
:==========================================================
:JOB            To act as primary entry to floating point suite,
:               save working registers on stack and expand f.p.
:               compressed format numbers to working format.
:ACTION         See comments.
:----------------------------------------------------------
:CPU            68000-series
:HARDWARE       None.
:SOFTWARE       Called by FPSUB, FPADD, FPMUL, FPDIV and FPSQRT.
:----------------------------------------------------------
:INPUT          D0 and D1 are two floating point numbers to the
:               format: bits 31-8: 24-bit mantissa,
:                       bits  7-0: 8-bit excess 128 exponent.
:OUTPUT         D1 to D5 are saved on stack.
:               CCR (NZVC all cleared) is on stack top.
:               D2.L = sign extended exponent of number D0.
:               D3.L = sign extended exponent of number D1.
:               D0(31-7) = expanded mantissa of number D0.
:               D1(31-7) = expanded mantissa of number D1.
:               D4 = sign extended exponent of zero number.
:ERRORS         None.
:REG USE        D0 D1 D2 D3 D4 CCR
:STACK USE      26
:RAM USE        None.
:LENGTH         44
:CYCLES         Not given.
```

```
:----------------------------------------------------------------
:CLASS 1        *discreet     *interruptable       *promable
:******         *reentrant    *relocatable         *robust
:================================================================
:
ENTRY  MOVEM.L D1-D5,-(A7)   :Save registers used in        48E7
                             :f.p. suite.                   7C00
       CLR.W   D2            :Form new CCR for stack        4242
       ROXL.B  #5,D2         :with all flags but X          EB12
       MOVE.W  D2,-(A7)      :cleared.                      3F02
:
       MOVE.B  D0,D2         :Move exponent 1 to D2 and     1400
       EXT.W   D2            :sign extend.                  4882
       CLR.B   D0            :Clear mantissa 1 lo-byte      4200
       ASR.L   #1,D0         :and expand 24-bit mantissa    E280
       BCHG    #30,D0        :to 25-bit for easier          0840
                             :overflow checks.              001E
:
       MOVE.B  D1,D3         :Move exponent 2 to D3 and     1601
       EXT.W   D3            :sign extend.                  4883
       CLR.B   D1            :Clear mantissa 2 lo-byte      4201
       ASR.L   #1,D1         :and expand 24-bit mantissa    E281
       BCHG    #30,D1        :to 25-bit for easier          0841
                             :overflow checks.              001E
:
       MOVE.W  #$FF80,D4     :Set D4 = sign extended        383C
                             :"zero exponent".              FF80
       MOVE.L  22(A7),-(A7)  :Move return address to top    2F2F
                             :of stack and return to        0016
       RTS                   :main f.p. routine.            4E75
:================================================================
```

DATASHEET 2

```
:================================================================
:= EXIT         Floating point exit routines.
:> DZEXIT       Set division by zero flag and exit.
:> NGEXIT       Set negative input flag and exit.
:> OVEXIT       Set overflow flag and exit.
:> UFEXIT       Set underflow flag and exit.
:> RESULT       Compress working format result and exit.
:================================================================
:JOB            To provide exit points compressing the f.p.
:               result or setting appropriate error flags and
:               restoring working registers saved by ENTRY.
:ACTION         See comments.
:----------------------------------------------------------------
:CPU            68000-series
:HARDWARE       None.
:SOFTWARE       ENTRY must have stacked registers in the correct
:               order.
:----------------------------------------------------------------
:INPUT          D0,D2 = f.p. result number (RESULT) or
:               unknown error (all other entry points).
:               Stack as after ENTRY with cleared CCR on top.
:OUTPUT         reg/flag     no error         error
:               D0           result           uncertain
:               D1-A7        as before ENTRY  as before ENTRY
:               X            as before ENTRY  as before ENTRY
:               N            result state     1 if negative input
:               Z            result state     1 if division by 0
:               V            0                1 if any error
:               C            0                0
:ERRORS         None.
:REG USE        D1 CCR  (D2 is used but restored to value saved
:               in ENTRY).
:STACK USE      -26
:RAM USE        None.
:LENGTH         58
:CYCLES         Not given.
:----------------------------------------------------------------
:CLASS 1        *discreet     *interruptable       *promable
:******         *reentrant    *relocatable         *robust
:================================================================
:
DZEXIT OR.W    #$06,(A7)     :Set stacked V & Z flags to    0057
                             :show division by zero,        0006
       BRA     EXIT          :then exit.                    602A
:
NGEXIT OR.W    #$0A,(A7)     :Set stacked V & N flags to    0057
                             :show negative input,          000A
       BRA     EXIT          :then exit.                    6024
:
OVEXIT OR.W    #$02,(A7)     :Set only stacked V flag to    0057
                             :show overflow error,          0002
       BRA     EXIT          :then exit.                    601E
:
UFEXIT OR.W    #$04,(A7)     :Set only stacked Z flag to    0057
                             :show underflow and            0004
       MOVE.B  #$80,D0       :set result exponent to        103C
```

```
                                ;"zero" value,               0080
         BRA      EXIT          ;then exit.                  6014

RESULT   CMP.B    #$80,D2       ;If result exponent is       0C02
                                ;zero, then use underflow    0080
         BEQ      UFEXIT        ;to set Z and zeroise.       67F0
         ASL.L    #1,D0         ;Else compress result        E386
         BCHG     #31,D0        ;mantissa into highest       0840
                                ;3 bytes of D0.              001F
         BNE      POSRES        ;Show mantissa sign in       6604
         OR.W     #$08,(A7)     ;stacked N flag.             0057
                                ;                            0008
POSRES   MOVE.B   D2,D0         ;Store result exponent.      1002
;
EXIT     MOVE     (A7)+,CCR     ;Get result CCR.             44DF
         MOVEM.L  (A7)+,D1-D5   ;Restore registers, then     4CDF
                                ;clear return address        003E
         ADDQ.L   #4,A7         ;stacked by call to ENTRY.   588F
         RTS                    ;Exit f.p. system.           4E75
;==============================================================
```

DATASHEET 3

```
;= JUSTFY         Justify or normalise f.p. number.
;==============================================================
;JOB              To normalise a working format f.p. number by left
;                 justifying the mantissa with correcting
;                 adjustment to the exponent.
;ACTION           See comments.
;--------------------------------------------------------------
;CPU              68000-series
;HARDWARE         None.
;SOFTWARE         UFEXIT.
;--------------------------------------------------------------
;INPUT            D0 holds expanded floating point mantissa.
;                 D2 holds sign extended floating point exponent.
;OUTPUT           D4 changed.
;                 D0 normalised.
;                 D2 contains exponent of normalised number.
;ERRORS           None.
;REG USE          D0 D2 D4 CCR
;STACK USE        0
;RAM USE          None.
;LENGTH           24
;CYCLES           Not given.
;--------------------------------------------------------------
;CLASS 1          *discreet      *interruptable   *promable
;******           *reentrant     *relocatable     *robust
;==============================================================
;
JUSTFY   BVS      JUSTRR        ;Skip if already justified.  6910
         MOVEQ    #23,D4        ;Else set loop limit.        7817
;
JUSTLP   SUBQ     #1,D2         ;Decrease exponent and left  5342
         ADD.L    D0,D0         ;shift mantissa, until       D080
         DBVS     D4,JUSTLP     ;overflow (justified) or     59CC
                                ;count out (not justified).  FFFA
;
         BVS      JUSTRR        ;Skip if justified, else     6904
         ADDQ.L   #4,A7         ;clear return address and    588F
         BRA      UFEXIT        ;exit with underflow.        60C6 *
;
JUSTRR   ROXR.L   #1,D0         ;Correct mantissa overflow   E290
         ADDQ.W   #1,D2         ;and adjust exponent, then   5242
         RTS                    ;return to main routine.     4E75
;==============================================================
```

DATASHEET 4

```
;==============================================================
;= FORMAT         Round and justify f.p. number.
;==============================================================
;JOB              To round and justify working format f.p. number.
;ACTION           See comments.
;--------------------------------------------------------------
;CPU              68000-series
;HARDWARE         None.
;SOFTWARE         JUSTFY, RESULT, UFEXIT, OVEXIT.
;--------------------------------------------------------------
;INPUT            D0 holds expanded 25-bit floating point mantissa.
;                 D2 holds sign extended floating point exponent.
;OUTPUT           D1 and D4 changed.
;                 V=0: D0 rounded to 24-bit value and normalised.
;                   D2 contains exponent of normalised number.
;                 V=1: overflow error, D0,D2 uncertain.
;ERRORS           None.
;REG USE          D0 D1 D2 D4 CCR
;STACK USE        4
;RAM USE          None.
;LENGTH           18
;CYCLES           Not given.
;--------------------------------------------------------------
;CLASS 1          *discreet      *interruptable   *promable
;******           *reentrant     *relocatable     *robust
;==============================================================
;
FORMAT   BSR      JUSTFY        ;Justify, then round up      61E6 *
         MOVEQ    #$40,D1       ;any set bit in least        7240
         ADD.L    D1,D0         ;significant place - 1,      D081
         BSR      JUSTFY        ;then justify again.         61E0 *
;
         ASR.W    #1,D2         ;Test exponent by shifting   E242
         ROXL.B   #1,D2         ;and back to original place  E312
         BVC      RESULT        ;taking the exit             68BC *
         BCS      UFEXIT        ;appropriate to the          65B0 *
         BRA      OVEXIT        ;exponent condition.         60A8 *
;==============================================================
```

DATASHEET 5

```
;==============================================================
;= XTSIGN         Extract mantissa sign & make absolute.
;==============================================================
;JOB              To compute the product or quotient sign of two
;                 working format f.p. mantissas and return the
;                 absolute values of each.
;ACTION           See comments.
;--------------------------------------------------------------
;CPU              68000-series
;HARDWARE         None.
;SOFTWARE         None.
;--------------------------------------------------------------
;INPUT            D0 and D1 contain two's complement numbers.
;OUTPUT           D0 and D1 contain absolute values.
;                 bit 31,D4 = sign(D0) EOR sign(D1).
;ERRORS           None.
;REG USE          D0 D1 D4 CCR
;STACK USE        0
;RAM USE          None.
;LENGTH           20
;CYCLES           Not given.
;--------------------------------------------------------------
;CLASS 1          *discreet      *interruptable   *promable
;******           *reentrant     *relocatable     *robust
;==============================================================
;
XTSIGN   MOVEQ    #1,D4         ;Clear result sign.          7801
;
         TST.L    D0            ;Test 1st number and skip    4A80
         BPL      NXTS1         ;if positive (absolute),     6A04
         NEG.L    D0            ;else make absolute and      4480
         NEG.W    D4            ;change result sign.         4444
;
NXTS1    TST.L    D1            ;Test 2nd number and skip    4A81
         BPL      NXTS2         ;if positive (absolute),     6A04
         NEG.L    D1            ;else make absolute and      4481
         NEG.W    D4            ;change result sign.         4444
NXTS2    RTS                    ;Exit with result sign.      4E75
;==============================================================
```

DATASHEET 6

```
;==============================================================
;= FPSUB          Floating point subtraction.
;> FPADD          Floating point addition.
;==============================================================
;JOB              To subtract or add two f.p. numbers, returning
;                 correctly normalised result or error information.
;ACTION           See comments.
;--------------------------------------------------------------
;CPU              68000-series
;HARDWARE         None.
;SOFTWARE         ENTRY, RESULT, JUSTFY, FORMAT.
;--------------------------------------------------------------
;INPUT            D0 = 1st number, D1 = 2nd number.
;OUTPUT           reg/flag       no error         error
;                 D0             result           uncertain
;
;                 D1-A7          unchanged        unchanged
;                 X              unchanged        unchanged
;                 N              result state     0
;                 Z              result state     0
;                 V              0                1 = overflow
;                 C              0                0
;ERRORS           None.
;REG USE          D0 D1 CCR
;STACK USE        30
;RAM USE          None.
;LENGTH           62
;CYCLES           Not given.
;--------------------------------------------------------------
;CLASS 1          *discreet      *interruptable   *promable
;******           *reentrant     *relocatable     *robust
;==============================================================
;
FPSUB    BSR      ENTRY         ;Convert input numbers to    6100
                                ;expanded working format.    FF58 *
         CMP.W    D4,D3         ;If 2nd no. = 0 then exit    B644
         BEQ      RESULT        ;with 1st no. as result,     679C *
         EXG      D0,D1         ;else exchange numbers,      C141
         EXG      D2,D3         ;and negate new 1st number   C543
         NEG.L    D0            ;for addition of negative    4480
         BSR      JUSTFY        ;value, justify it and       61B2 *
         BRA      FPADDX        ;go to addition test.        6010
;
FPADD    BSR      ENTRY         ;Convert input numbers to    6100
                                ;expanded working format.    FF52 *
         CMP.W    D4,D2         ;Test 1st number and if no   B444
         BNE      FPADDX        ;0 then skip, else           6608
         MOVE.L   D1,D0         ;2nd number is result, so    2001
         MOVE.W   D3,D2         ;move to result registers    3403
         BRA      RESULT        ;and exit with result.       608E *
;
FPADDX   CMP.W    D4,D3         ;If 2nd number = 0 then      B644
         BEQ      RESULT        ;result is 1st number, else  678A *
         CMP.W    D3,D2         ;test magnitudes, placing    B443
         BGE      ADDNUM        ;largest in result           6C04
         EXG      D0,D1         ;registers, D0 & D2.         C141
         EXG      D2,D3         ;                            C543
;
ADDNUM   MOVE.W   D2,D4         ;Get exponent difference     3802
         SUB.W    D3,D4         ;in D4 for later shift       9843
         CMP.W    #24,D4        ;count, but test for         0C44
                                ;shift count exceeding       0018
         BHI      RESULT        ;precision, if so exit       6200
                                ;with result = 1st no.       FF78 *
         ASR.L    D4,D1         ;Make 2nd mantissa same      E8A1
         ADD.L    D1,D0         ;order as 1st and add it     D081
;
         BRA      FORMAT        ;then format and exit.       60A6 *
;==============================================================
```

DATASHEET 7

```
;==============================================================
;= FPMUL          Floating point multiplication.
;==============================================================
;JOB              To multiply two f.p. numbers, returning correctly
;                 normalised result or error information.
;ACTION           See comments.
;--------------------------------------------------------------
;CPU              68000-series
;HARDWARE         None.
;SOFTWARE         ENTRY, UFEXIT, XTSIGN, FORMAT.
;--------------------------------------------------------------
;INPUT            D0 = multiplicand, D1 = multiplier.
;OUTPUT           reg/flag       no error         error
;                 D0             product          uncertain
;                 D1-A7          unchanged        unchanged
;                 X              unchanged        unchanged
;                 N              result state     0
;                 Z              result state     0
```

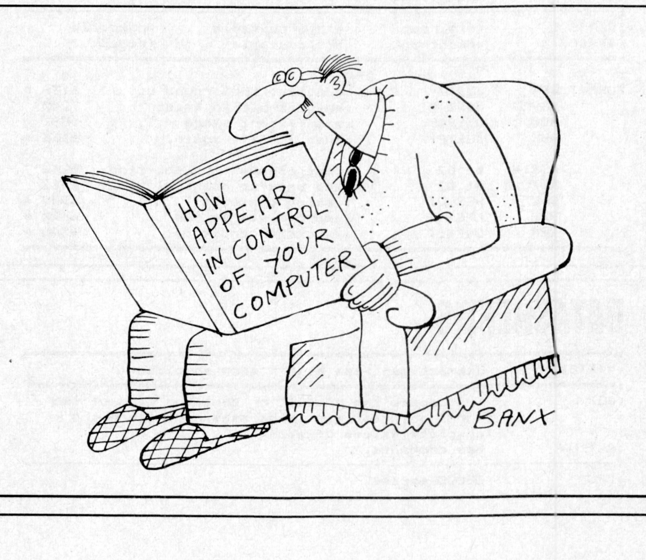
```
:               V               0                1 = overflow
:               C               0                0
:ERRORS         None.
:REG USE        D0 D1 CCR
:STACK USE      30
:RAM USE        None.
:LENGTH         52
:CYCLES         Not given.
:------------------------------------------------------------------
:CLASS 1        *discreet       *interruptable       *promable
:******         *reentrant      *relocatable         *robust
:
:==================================================================
FPMUL   BSR     ENTRY           :Convert input numbers to        6100
                                :expanded working format.        FF26 *
:
        CMP.W   D4,D2           :Test 1st no. for zero and       B444
        BEQ     UFEXIT          :if so, exit via underflow       6700
                                :to return zero result.          FF5E *
:
        CMP.W   D4,D3           :Test 2nd no. for zero and       B644
        BEQ     UFEXIT          :if so, exit via underflow       6700
                                :to return zero result.          FF52 *
:
        BSR     XTSIGN          :Get absolute values and         6196 *
        MOVE.W  D4,-(A7)        :stack product sign.             3F04
        CLR.L   D5              :Clear product accumulator       4285
        MOVEQ   #24,D4          :Set mul loop count.             7818
:
MULOOP  ADD.L   D1,D1           :Test next multiplier bit        D281
        BCC     MULPNA          :skip if no add this place       6402
        ADD.L   D0,D5           :else add multiplicand.          DA80
MULPNA  LSR.L   #1D0            :Shift multiplicand to next      E288
        DBRA    D4,MULOOP       :place, repeat for 25 bits       51CC
                                :ensuring correct rounding       FFF6
:
        ADD.W   D3,D2           :Add exponents.                  D443
:
PRODCT  MOVE.L  D5,D0           :Put mantissa in result reg      2005
        TST.W   (A7)+           :and test result sign, skip      4A5F
        BMI     PRODMI          :to 1 negate if negative.        6B02
        NEG.L   D0              :Negate at least once to         4480
PRODMI  NEG.L   D0              :give correct V flag.            4480
        BRA     FORMAT          :Exit through format             6000
                                :routine.                        FF6E *
:==================================================================
```

DATASHEET 8

```
:==================================================================
:= FPDIV        Floating point division.
:==================================================================
:JOB            To divide two f.p. numbers, returning correctly
                normalised result or error information.
:ACTION         See comments.
:------------------------------------------------------------------
:CPU            68000-series
:HARDWARE       None.
:SOFTWARE       ENTRY, DZEXIT, UFEXIT, XTSIGN, PRODCT (in FPMUL).
:------------------------------------------------------------------
:INPUT          D0 = dividend, D1 = divisor.
:OUTPUT         reg/flag        no error         error
:               D0              quotient         uncertain
:               D1-A7           unchanged        unchanged
:               X               unchanged        unchanged
:               N               result state     0
:               Z               result state     1 = division by 0
:               V               0                1 = error flag
:               C               0                0
:ERRORS         None.
:REG USE        D0 D1 CCR
:STACK USE      30
:RAM USE        None.
:LENGTH         50
:CYCLES         Not given.
:------------------------------------------------------------------
:CLASS 1        *discreet       *interruptable       *promable
:******         *reentrant      *relocatable         *robust
:
:==================================================================
FPDIV   BSR     ENTRY           :Convert input numbers to        6100
                                :expanded working format.        FEF2 *
:
        CMP.W   D4,D3           :If 2nd number = 0 then          B644
        BEQ     DZEXIT          :exit setting "division by       6700
                                :zero" error flag.               FF18 *
:
        CMP.W   D4,D2           :If 1st number = 0 then          B444
        BEQ     UFEXIT          :exit via underflow to           6700
                                :return zero result.             FF24 *
:
        BSR     XTSIGN          :Get absolute values and         6100
                                :quotient sign, saving           FF72 *
        MOVE.W  D4,-(A7)        :sign on stack for later.        3F04
        MOVEQ   #24,D4          :Set div loop count.             7818
        LSR.L   #1,D0           :Adjust dividend to prevent      E288
        ADDQ.W  #1,D2           :erroneous overflow.             5242
:
DIVLP   SUB.L   D1,D0           :Try to subtract divisor,        9081
        BCC     DIVOK           :skip if subtraction okay,       6402
        ADD.L   D1,D0           :else add divisor back.          D081
DIVOK   ADDX.L  D5,D5           :Shift result complement.        DB85
        ADD.L   D0,D0           :Shift dividend one place        D080
        DBRA    D4,DIVLP        :and repeat 25 times to          51CC
                                :ensure correct rounding.        FFF0
:
        NOT.L   D5              :Correct complemented            4685
        ASL.L   #7,D5           :result & move to position.      EF85
        SUB.W   D3,D2           :Subtract exponents and          9443
        BRA     PRODCT          :complete as for mul.            60BE *
:==================================================================
```

DATASHEET 9

```
:==================================================================
:= FPSQRT       Floating point square root.
:==================================================================
:JOB            To extract the square root of a f.p. number,
                returning correctly normalised result or error
:               information.
:ACTION         See comments.
:------------------------------------------------------------------
:CPU            68000-series
:HARDWARE       None.
:SOFTWARE       ENTRY, UFEXIT, NGEXIT, FORMAT.
:------------------------------------------------------------------
:INPUT          D0 = square.
:OUTPUT         reg/flag        no error         error
:               D0              root             uncertain
:               D1-A7           unchanged        unchanged
:               X               unchanged        unchanged
:               N               0                1 = negative input
:               Z               root state       0
:               V               0                1 = error flag
:               C               0                0
:ERRORS         None.
:REG USE        D0 CCR
:STACK USE      30
:RAM USE        None.
:LENGTH         80
:CYCLES         Not given.
:------------------------------------------------------------------
:CLASS 1        *discreet       *interruptable       *promable
:******         *reentrant      *relocatable         *robust
:
:==================================================================
FPSQRT  BSR     ENTRY           :Convert input number to         6100
                                :expanded working format.        FEC0 *
:
        CMP.W   D4,D2           :If square = 0 then exit         B444
        BEQ     UFEXIT          :via underflow to                6700
                                :return zero root.               FEF8 *
:
        TST.L   D0              :If square is negative           4A80
        BMI     NGEXIT          :then exit setting               6B00
                                :"negative input" flags.         FEE6 *
:
        ADDQ.W  #1,D2           :Root exponent by rounding       5242
        ASR.W   #1,D2           :and halving, correcting         E242
        BCC     SQRTNS          :mantissa if exponent was        6402
        ASL.L   #1,D0           :even.                           E380
:
SQRTNS  ROL.L   #8,D0           :Move mantissa into low          E198
        MOVEQ   #0,D1           :byte D1 and high word D0,       7200
        MOVE.B  D0,D1           :clearing all other bytes        1200
        CLR.B   D0              :of D1,D0.                       4200
:
        MOVEQ   #$40,D3         :Set initial subtrahend.         7640
        MOVEQ   #23,D4          :Set root loop count.            7817
:
SQLOOP  SUB.L   D3,D1           :Try subtracting part root       9283
        BCC     SQLSUB          :and skip if okay, else          6402
        ADD.L   D3,D1           :add back.                       D283
:
SQLSUB  ROXR.B  #1,D3           :Shift part root up one          E213
        ADDX.L  D3,D3           :place getting corrected         D783
        EOR.W   #$100,D3        :result in bit 8, leaving        0A43
                                :bit 6 set.                      0100
:
        ADD.L   D0,D0           :Shift next bit pair of          D080
        ADDX.L  D1,D1           :square remainder up into        D381
        ADD.L   D0,D0           :place.                          D080
        ADDX.L  D1,D1           :                                D381
        DBRA    D4,SQLOOP       :Repeat 24 times giving          51CC
                                :24-bit chopped root.            FFE8
:
        ROXR.L  #1,D1           :Extract last bit                E291
        LSR.L   #1,D3           :for rounding.                   E28B
        CMP.L   D3,D1           :                                B283
        BCS     SQRTNX          :                                6504
        OR.B    #$40,D3         :                                0003
                                :                                0040
SQRTNX  MOVE.L  D3,D0           :Move root to result reg         2003
        BRA     FORMAT          :and exit after formatting.      6000
                                :                                FEF2 *
:==================================================================
```



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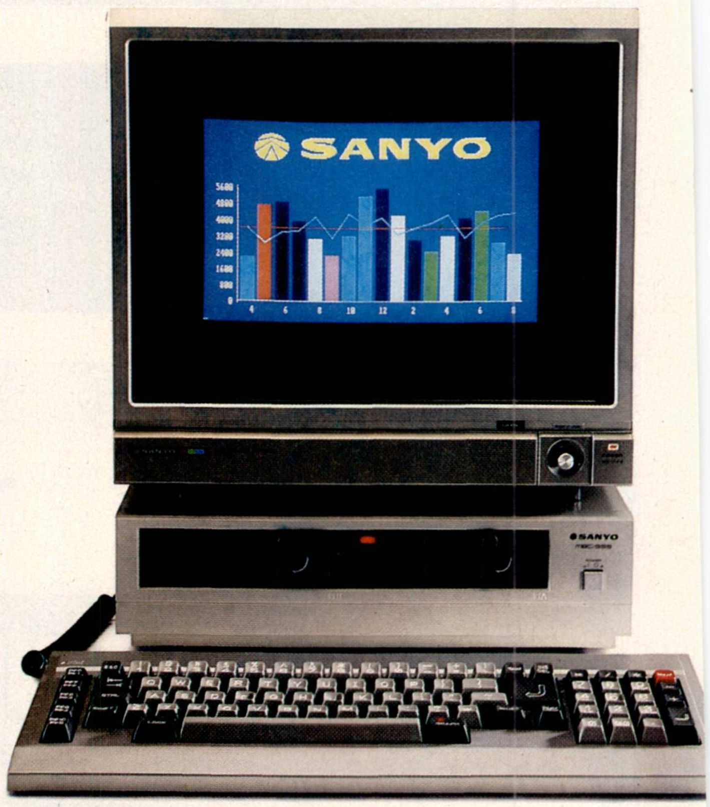

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America online

It's a mixed comms bag this month, with BBS news, a Fido update and a list of American systems.

A number of bulletin board systems have come online recently, and here are some details.

There's a couple of systems for Commodore users. The first runs on a Commodore 64 in Aberdeen on (0224) 781919 (24 hours, V21). The second is a TBBS devoted to Commodore users called Eire International Resource Exchange (EIRE for short!). This is Bell 103 and 212 tones only at present, and runs 24 hours a day in Limerick on (010) 353 61 74614 (Bell 212 is the same as V22 1200 full duplex). A 10-minute call to Eire costs a little over £2 at cheap rate.

Liverpool Mailbox now has a special Commodore section run by Phil Jones, so call and help fill up the message area.

For CP/M users, a remote CP/M (although it's more in the style of a CBBS than a basic remote CP/M system) called Pete's Place can be found on Colchester (0206) 862354 (24 hours, V21).

In Swansea there's a new FBBS on (0792) 203953. This has colour for BBC users, and again is a 24-hour system.

In Northern Ireland there's a system called SBBS II — The Irish Man. It runs on the BBC and the hours are 9am to 11pm (ring-back) and 11pm to 9am (direct). It supports V21 and V23, and is 16 years old. Special areas include music (pop and classical), graffitti, sales and wants, as well as standard mail facilities. The phone number is (0247) 455162.

For Atari users there's a new 24-hour Atari-based system in London on (01) 638 2034.

Dial code from UK : 010 1
Cost for 10 mins : £5.84 (Standard £6.70, peak £7.24)

Sysop's Name	Number (010 1)-	System Name
Barton, Ben	901 363 3659	TBBS Memphis, TN
Behymer, Larry	402 489 1400	Prancing Pony, Lincoln NE
Brenton, Jeffrey	815 337 0279	First CHART-Board, Woodstock IL
Bridwell, Robert	405 357 6181	Info-Net, Lawton,OK
Brown, Steve	317 881 3849	Indy-Exchg., Indianopolis IN
Dalton, David	919 922 3308	Science Fiction Writers' Network
Driscoll, Brian	215 739 9512	Exclusive-80, Phila. PA
Feins, Ed	201 486 2956	CFONJ
Funk, Gary	501 442 8777	Fayetteville, AR
Furniss, Rick	208 745 9438	ITBBS - Idaho
Gerritz, Jim	303 781 1079	Photo Tech Board
Gibson, Benn	316 221 3276	"9th & Main", Winfield, KS
Glaskowsky, Peter	305 235 1645	John Galt Line, Miami, FL
Grosse, Garry	214 234 0418	TUUG Dallas TX
Hoffman, Bob	301 997 5091	Sonshine Info Svc, Columbia MD
Hummel, Bill	214 528 7141	Computer Solution, Dallas TX
Jackson, Stu	313 286 0145	Serial Port, Mt. Clemens MI
Johnson, Anton	415 651 4147	Aardwolf Express, Fremont CA
Law, Bob	601 264 2361	Southern Bullet, Hattiesburg MS
Marlowe, Richard	305 671 5913	The Pigsty
Marlowe, Rob	813 856 5071	Inner Sanctum, Hudson FL
Melan, Peter	608 752 7840	J.A.D.E., Janesville, WI
Meredith, Art	513 528 0707	Cathouse, Cincinatti, OH
Morris, James	417 869 5294	Comp. Matrix, Springfield MO
Nall, Robert	913 273 1550	Nat'l Assn Modem Users, Topeka
Patton, Barry	415 547 3070	MEGACOM, Piedmont, CA
Phillips, Ralph	318 742 6149	TBBS Shreveport, LA
Schaff, Jeffrey	304 652 1416	River Cities Smart BBS, WV
Schreiber, Bill	704 262 1861	TBBS, Boone NC
Schwarz, Ralph	603 886 1371	The Outpost, Nashua NH
Small, Greg	416 640 3434	Stouffville, Ont.
Smith Gary J.	919 722 2135	Humanities Forum, NC
Vaughan, Robert	304 925 3338	21st Cent., Charleston WV
Veritas, Vincent	303 694 9050	Grotto Lounge, Denver CO
Wall, Larry	602 344 8070	CPTBBS, Yuma, AZ
Whisenhunt, Perri	214 566 1374	TBBS Tyler, TX

Fig 1 American TBBSs

Apricot users are also receiving BBS support from Gosport Apricot BBS on (0705) 524805, which is a 24-hour system with a hard disk and 1Mbyte of RAM. It is sponsored by Gosport Computer Centre.

A specialist Macintosh system, Mactel, has been listed for some time, but has been having teething problems with interfacing US software to a UK modem. It should have settled down by now, and is on the old TBBS Nottingham number, (0602) 289783 (24 hours, V21/V23).

For those interested in outer space, a group of computer hobbyists working at the European Space Agency's European Space Research and Technology Centre, ESTeC, which is in Holland, have bodly set up a BBS. This runs on a BBC Micro, and offers information on ESA activities as well as the usual BBS facilities. It runs in English.

A new Fido system, LaserMail, has recently gone online. It offers the usual Fido facilities plus telex, telemessage and private mailboxes. The number is (0903) 39290, and is a 24-hour online system.

In last month's description of Fido, I omitted to mention that Fido Haunting Thunder carries support for Olivetti users, being a database and message system for the UK Olivetti Users' Group. It runs 24 hours a day on (0752) 364 059.

Finally as far as new numbers are concerned, I've been taken to task by the Great Goblin, Sysop of the Gnome at Home for not mentioning his system. It runs on networked BBC Micros with at least two lines (engaged tones should be less likely). The number is (01) 888 8894, and it is a 24-hour viewdata-type system (V23).

American systems

Fig 1 is a list of US TBBSs which accept V22 and V22bis (1200 and 2400 full duplex) calls as well as the normal Bell 103 tones. Consequently, you are more likely to get a successful connection than with the 300/1200 systems.

If you have ever called a system in the US, you will know that it can be very difficult to get a strong tone from the modem at the other end. The reason is that the connection between the UK and

the US is liable to be cut off by BT monitoring equipment if it detects certain tones, which is something to do with the tones straying into forbidden (in the UK) frequency bands. The new generation of 2400 bits/sec US modems doesn't seem to cause these problems. With the older systems, you often have to redial several times before a steady tone emerges.

The cheap-rate period for calls to the US is 8pm to 8am, not 6pm. END

UK free networks

Bulletin Board	Phone Number	Notes
Aberdeen ITEC	(0224) 641585	V.23
BABBS-Bath	(0225) 23276	300/300 baud rate; 9pm-8am weekdays, 9pm-noon weekends; Atari-based system, ring-back system
BABBS-Felixstowe	(0394) 276306	300/300 baud rate; 24 hours daily; Apple users' group
BABBS TWO-Basildon	(0268) 778956	300/300 baud rate; 24 hours daily; Apple users' group with special area for queries to Apple UK
Basildon ITeC	(0268) 22177	Prestel type service
	(0268) 25122	Atari based 300 baud. 24 hour
BASUG	(01) 373 6337	24 hour
Blandford Board TBBS	(0258) 54494)	300/300 baud rate; 24 hours daily
CABB TBBS	(01) 631 3076	300/300 baud rate; 24 hours daily + 1200/75
CBBS SW	(0392) 53116	300/300 baud rate; 24 hours daily
CBBS Surrey (Woking)	(04862) 25174	1200/75 and 300/300 baud rates; 24 hours daily; jokes, jobs, reviews, news
Chatham (Kent)	(0634) 815805	6pm/9am daily + weekends 7 bits, even parity; sales and wants — cars, houses, computers
CNOL Lancaster TBBS	(0524) 60399	300/300 baud rate; 24 hours daily; Clinical Notes Online service, mainly for medical users; works in conjunction with a database on the Datastar network
Computers Incorporated Newcastle (CBBS)	(0207) 543555	300/300 baud rate; 24 hours daily; primarily business-oriented
Forum 80 Hull	(0482) 859169	300/300 baud rate; 5-11.30pm weekdays, noon-11.30pm Sundays, Bell 103 standard, midnight-8am daily; international electronic mail, library for up/downloading
Forum 80 SPA	(0926) 39871	300/300 baud rate; 11pm-midnight daily; TRS-80 and Genie users' group
Forum 80 Wembley	(01) 902 2546	300/300 baud rate; 7-10pm weekdays, midday-10pm weekdays; electronic mail, library for down loading; ring and ask for Forum 80
Fido Compulink	(06286) 63571	24 hour
Fido Fastnet	(051) 260 5607	10pm-8am BELL 103/212a tones only at present
Fido Fore TBBS	(01) 301 4110	Fido 1am-8am
Hackney BBS	(01) 985 3322	V.23 Password: PUBLIC
Hamnet Hull	(0482) 497150	300/300 baud rate; 6pm-8am daily
Livingstone, Scotland	(0506) 38526	Atari, 24 hours daily
London Underground	(01) 863 0198	24 hours V.21/V.23 (Viewdata coming soon) BBC Based (colour for BBC users)
Liverpool Mailbox TBBS	(051) 4288924	300/300 baud rate; 24 hours daily; sponsored by INMAC; electronic mail, program downloading, TRS-80 information; messages for *PCW* can be left on the board and will normally be read by us within 24 hours
Mactel (Nottingham)	(0602) 289783	V.21/V.23 Macintosh users 24 hours daily
Mailbox-80 W Midlands Stourport TBBS	(0384) 635336	300/300 baud rate; 6pm-8am daily
Manchester Open Bulletin Board TBBS	(061) 7368449	300/300 baud rate; 24 hours daily + 1200/75
Marctel	(01) 346 7150	10am-10pm daily (24 hour coming, watch for announcement on Marctel) BBC based system (FBBS) with colour for Commstar users
MBBS-Mitcham	(01) 648 0018	300/300 baud rate; 24 hours; BBC-based system with jokes, graffiti, electronic mail, and Atari and BBC sections
MG-Net CBBS London	(01) 399 2136	300/300 baud rate; 5-10pm Sunday; electronic mail, program downloading
Microweb Manchester TBBS	(061) 4564157	300/300 baud rate; 24 hours daily; *Micro User* magazine, mainly for BBC users
NBBBS-North Birmingham TBBS	(0827) 288810	300/300 baud rate; 24 hours daily
NBBS-E BBC Micro	(0692) 630186	BBC Based 24 hours daily V21/V23
NBBS Lutterworth	(04555) 4798	Mon-Fri 8pm-8am, weekends 24 hrs
NKABBS	(0795) 842324	9.30pm-midnight
OBBS Manchester	(061) 4271596	300/300 baud rate; 24 hrs except 10am-10pm
Octopus RAS	(0272) 421196 (Bristol)	6pm-8.30am V21 using public domain Octopus software
PIP-Sheffield TBBS	(0742) 667983	300/300 baud rate; 24 hours daily. Bell 9pm-8.00am
REACT UK	(0376) 518818	24 hours. Mainly Dragon
SABBS Glasgow	(0698) 884804	Atari, 24 hours daily
SBBS Southern	(0923) 676644 (Watford)	11pm-8.30am daily; BBC based V.21/V.23
Southern BBS	(0243) 511077	300/300 baud rate; 8pm-2am daily; ring-back system (dial the number, let phone ring once, and then ring back); messages, downloading
Stoke ITEC	(0782) 265078	1200/75 Viewdata system; 24 hours daily
TBBS London	(01) 348 9400	300/300 baud rate; 9am-7pm daily
TYNESIDE BBS	(091) 251 4271	V.21 BBC based
VISA	(01) 958 7098	8am-11pm daily V23 Prestel type
WABBS-Worthing	(0903) 42013	300/300 baud rate; 24 hours daily; ring-back system (dial the number, let phone ring once, and then ring back); Atari-based

UK subscriber commercial/business systems

Bulletin Board	Phone Number	Notes
Comet	(0527) 28515	Message handling system: Details from Istel Ltd, Grosvenor House, Prospect Hill, Redditch, Worcs
Micronet 800	(01) 278 3143	Prestel database information for micro users. Details from Micronet 800, 8 Herbal Hill, London EC1R 5EJ
Prestel	Freefone 100 Prestel sales	Subscribers only
Telecom Gold	(01) 403 6777	All information from Sales Admin, 60-68 St Thomas Street, London SE1 3QU

END ZONE

TRANSACTION FILE

Your chance to buy, sell or swap equipment.

● FOR SALE: Cotron RGB-monitor 24in screen £1299. Also 2 Digisolve LVVGP.4E Vector processors, ideal hi-res microcomputer graphics, 64 and 4096 colours £500, and £1000. Offers considered. L. Williams, (01) 249 2016 after 6pm.

● COMMODORE 3040 disk drives £250, PET to Centronics printer interface £20, OKI microline 82A £175, VAT included. Tel: (0934) 838187 write Mr. Day, 17 Elm Close, Yatton Avon BS19 4EL. Buyer collects.

● TANDY TRS80 Mod-1 Level-2. 48k, upper/lower case, twin drives, two tape recorders, 80micro magazines, manuals, software. Basic instruction course, assembler/editor, flight simulator, games, £300. Tel: Radnage (024026) 2718.

● GEMINI DUAL MICROPOLIS DISK UNIT. 400k, per disk, 800k total. £150 ono. Tel: (01) 580-2949.

● NEWBRAIN Model A, software computer cassette recorder, 50+ micro magazines, cost £300+, sell for £90. Epson MX Serial interface, offers. Tel: (061) 796 9714 evenings.

● SENDATA 700; acoustic coupler/modem for Osborne. Top quality. 300/300 baud, answer/originate, CCITT tones, BT approved, powered via modem port. Little used. £75. North London. Tel: (01) 444 6244, eve.

● BBC Model 'B'. Cumana 40 track disk. DFS. Prestel modem + chip, joysticks games galore, Microvitec monitor, Torch Z80 disk pack, twin 400k drives, Perfect software. Mint condition. Offers over £750. (Yateley). Tel: (0252) 876775.

● AMSTRAD CPC-464. Mono screen & DK Tronics speech synthesiser & 3in single disc drive & Kaga Taxan KP-810 printer, £500+ software & magazines, books, discs: Tasword, Masterfile, Pascal 4T, games, VGC, £650 ono (no split). Rick. Tel: 444-9132.

● APRICOT F1. 1×720k disk drive, 9in monitor, Juki 6100 daisywheel printer. Superplanner, Superwriter, Supercalc. Purchased February 1985, still under guarantee. Offers around £1,325. Ware (0920) 3459.

● BROTHER EP-44, electronic typewriter-computer printer+ terminal. Letter quality print. Ideal for word-processing. Can be used as Telecomm terminal with modem. As new, sell £180. Tel: (0922) 612025 (day).

● 2001 CBM. With Basic 4, Visicalc & Commando. 4040 disc, 3022 printer, £750 or will separate. E. J. Aston Tel: (0785) 813241 (day), or (0785) 56558 (eve).

● PRISM-80, correspondence quality printer. Sheet feeder, graphics and sprint options. Over 200cps, both Parallel and Serial interfaces. Complete with Centronics and BBC interface cabels, £525 ono. Tel: (0480) 301552.

● BBC 'B'. DES, disc drive, colour monitor, sideways RAM, and cassette deck, as new £450. Tel: (0283) 67966.

● MEMOTECH MTX50C. Boxed as new 96k RAM, 40k ROM. Basic, Pascal, assembler, all resident. Joystick, £40. Software, cost over £450, sell for £250 ono. Tel: (01) 598 9412 any time.

● ZX PRINTER; and 11 rolls thermal paper £49. ZX custom case for Spectrum and peripherals £29. Both perfect, never used. Also Tantel Prestel adaptor, perfect £59. Tel: Mike on (0707) 371-560 (office) (0992) 311-57 (home).

● COMMODORE 8032 with 4040 disk drive, manuals, large quantity of educational utility and business software, £450. Tel: Danny Doyle (0908) 664545 days, or (0280) 813346 eve. No offers please.

● ADVANCE 86B, 256k IBM compatible, with colour graphics, two 360k drives, parallel printer and RS232C interfaces. Hitachi b/w hi-res monitor, keytronic keyboard, £775 ono. Tel: Alex Luton (0582) 840136 eve.

● WANTED: CBM 8032 and 8050 disk drive. In perfect working order. Please contact Jackie Franklin Farnborough (0252) 510223.

● TRS-80 MOD-I 48k. Twin Teac drives. Green monitor, Ldos Newdos Visicalc word processor project, manager utilities, 100 discs with much more software selling to finance IBM-PC. £350 Smith. Tel: 034458809 9am-4pm.

● TRS 80 MODEL 1 L2 EXPANSION INTERFACE 48k. LWR/case, 2 d/drives, Smaldos, Pascal, Wordpro, assembler, diagnostics, simulator, games, sound, pop-up disk. Box-lockable. Only £295. Tel: 09277-62683.

● APPLEIII 256k RAM. Built-in disk drive. Joystick, printer, RS232 ports, video &RGB outputs. Software: SOS, basic, Apple II emulation. Unused, surplus to requirements, £499. Tel: Mantell 096 278 (Hants) 619.

● ASSORTED EQUIPMENT: Dual Teac disc drives, single sided, integral PSU, 40/80 switchable. £300. NEC 8023P printer, screen dump, view printer driver. £250. Casio FX702P and cassette interface. Offers! Tel: (0223) 323428.

● COMMODORE PET PROFESSIONAL COMPUTER. 2001-8 32k, 4040 twin disk drives, 3022 dot matrix printer, cassette player, Wordcraft word processing, manuals, many games, extras. Perfect condition. £450 ono. Tel: 0829 260868 (Cheshire).

● BBC "B'", DFS 1.2, 100k disk drive (Acorn), PW1080A printer, cassette recorder, BCPL, other software, 30 disks, 200 sheets paper, books, £650 ono. Tel: 0452 863046 (Gloucester), Mr. Harman.

● MICROWRITER with charger/mains adaptor, TV/monitor interface, cables, carrying case, user's guide, manual, reference cards, Sirius/Microwriter communications software, £350. Tel: Hassocks 3430 (after 6pm).

● APPLE II PASCAL. Boxed set, four disks and manuals. Perfect, worth £220 new. Sell for £120 ono. Contact Cliff Steeler, Tel: (0767) 81841 (eves).

● 96k NEWBRAIN SYSTEM. Includes memory expansion interface, single 200k drive, integral power supply and disk controller. Slot for second drive. Word processor, spreadsheet, CP/M full documentation, London, £750. Tel: (01) 940-0393.

● APPLE IIe GRAPHIC MOUSE SYSTEM WITH MOUSE. Connection software and manual. Boxed and unused £62. Also for ii and ii+ £62. Wildcard, unused. For 11+ with Ramcard £35. Tel: Glos 29574.

● SINCLAIR QL Microvitec 653 monitor, books and Psion chess. Very good condition only six months old, £580 ono. Will sell separately. Tel: 0256 881845 after 6pm for further details.

● CBM 4032 PET. 8050 dual druve, C2N cassette, Centronics 737 printer. All leads, covers and manuals, plus some business software. Best offer will secure. Tel: (01) 373-5329.

● TANDY MODEL 4P. Still g'teed, 128k, twin d/ddrives, RS232 etc. Centronics 737 printer + acc software including Dbasell, Trsdos6, games etc. Ideal machine for home or business. £850 ono. Tel: (0977) 791 356.

● SHARP MZ80A COMPUTER. Integral screen, cassette deck, MZ80 PS friction and tractor feed printer, MZ8AEU expansion unit. Hardly used. Manuals included. £650 ono. Tel: Ternhill 716. Will deliver within 40 miles.

● SHARP MZ80A. Dual disk, CP/M, Forth, 'C', Basic, plus games, £250. Will not separate! Tel: (01) 736-3678 (eves).

● TRS80 MODEL 1 LEVEL II 48k. Lowercase, twindisk drives, s/double density. Printer II, manuals. Scripsit, Editor/assembler. Cassette recorder: Edtash, Scripsit, Chess, Checkers. "Basic faster and better" etc, £350. Tel: Wolverhampton 755640.

● SINCLAIR QL & MICROVITEC MONITOR VERSION TWO PSION! Some good books, EVH, Lansa of Havoc games, complete set QL User. Excellent home and business, £525. Tel: John on (01) 693-1720 anytime.

● SHARP MZ-700 64k RAM, colour, built-in tape recorder, softwsare. Still boxed, as new, £160. Tel: (0843) 68211 eves, please.

● WANTED: Personal Computer News, issue 101, March 2nd. Issue 108 April 27th. £1 each paid. Must be VGC. G.J. McDonald, 221 Macnaghten House, Compton Place, London WC1H 9SD.

● BUSINESS SYSTEM AND SOFTWARE WANTED, reasonable. Also beginners outfit, no games. Tel: (Bradford) 0274 307763 Simmon. Office house.

● 96k LYNX. With cassette recorder and tapes, Serial and Parallel interfaces. Ideal hobbyist machine, full documentation, Sybex Z80 manual, M/C monitor, all user group mags, superb graphics, £120. Tel: (01) 693 3995.

● OLIVETTI M20. With 311 Daisywheel printer and sheetfeed. Operating System and Oliword WP. 128k RAM Twin Disk Drives. Also, OUME S9/35 KSR Daisywheel printer. Best offers secure. Tel: (01) 636-3205

● SILVER REED EX43 PRINTER/TYPEWRITER. Parallel Centronics interface, printer driver. The lot, £250. No splitting. Write: E. Collins, 21 Molloy Street, Meersbrook, Sheffield, S8 9QN. Buyer Collects.

● APPLE II+. 64k, two disk drives, amber monitor, UHE and colour card, paddles, manuals, £565. Might split. Magicalc, with manual £35. Tel: Harpenden 3398 (eves).

● COMMODORE CBM3032 COMPUTER. CBM4040

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Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

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diskdrive, CBM3022 printer, C2N cassette deck, Visicalc, Wordpro + other software, also manuals etc. All VGC. Price £550 ono. Tel: Oxshott (037284) 3748 anytime.

● VIC-20 FOR SALE. Complete computer system. Cassette, unit, motherboard, 8k expansion, assembler cartridge, 2 joysticks, 5 books, my programming notes. Worth £250+, £400 (software). Want £200. Contact Mr. P. Chapman on Cromer (0263) 761681.

● NORTHSTAR ADVANTAGE CP/M micro. With two 320k disk drives, CP/M operating system, word processing software, and Serial and parallel ports £700 ono. Tel: (01) 674-5219 and ask for Garey.

● HEWLETT PACKARD HP41C. With Xfunctions; 446REGS (=3k); card reader; maths, stats, finance packs: Offers. Horsham 722327 or (01) 606-7788 ext 3226 Cornford

● SHARP MZ80k. 48k, joystick and dust cover, and about £100 of software: including two Basics, Cecil, front panel, and several games. Very good condition. Only £200. Tel: Hereford (0432) 272095.

● BROTHER EP44, Portable printer/typewriter. With RS232 computer interface. Accessories included and full instruction manuals. Excellent condition, £150 ono. Tel: Brookwood (04867) 89498 eve (Surrey).

● APPLE II EUROPLUS Double disk drives, monitor, manuals, games paddles. Privately used, all in good condition. £450. Tel: (01) 398-3761 (eves).

● HEWLETT PACKARD HP150. 256k, 2{10k drives, touch screen monitor, plus software. New in boxes. £2100. Tel: 07914 4823.

● MEMOTECH MTX: 2 tape based programs from Elstreee spreadsheet and database £35 each. Excellent condition, used only once. Write to John Metcalfe, 122 Tennyson Avenue, Harrogate, North Yorkshire, HG1 3LF.

● OMNI-READER. Text reader for sale, to suit IBM PC, Apricot computers, £300 ono. Needs software to suit your computer, available from Oberon International. Tel: Leicester 553442 after 6pm any night.

● SIRIUS. 256k, twin disk drives, 1200k each, £1100. Tel: Som (04605) 2039.

● BBC Model B. Boxed with manual etc, books and music composer. Excellent condition £260. Tel: (01) 226-5590 (eve).

● BBC Model B: Z80 second processor; Telesoftware downloader, tein double sided 40/80 disc drives, colour monitor. Software includes Fortran, Pascal, 'C', Wordstar and others, £990 ono. Tel: Aylesbury (0926) 748786 after 7pm.

● SHARP MZ80A. 40/80 column modification. Centronics printer interface and cable, WDPRO word processor program, and other misc software/all manuals, £240 ono. Tel: (07875) 2846, Earls Colne near Colchester.

● THE PRICE IS RIGHT! Apple software. Fast DOS, Decathlon, Music Maker, Sargon II, Scrabble. Only £15 each. Tel: Arnold on (0734) 693262 day. All packaging and manuals included.

● APPLE II+ extensively expanded — hardware. Worth over £2500 with software worth over £2000. Numerous manuals, books and magazines. The whole lot for only £1300 including more than 100 disks. Tel(01) 854-5854.

● SHARP MZ80B. With dual disk drives and printer interface for the Epson FX80 printer, (printer not included). £700. Tel: Telford (0952) 55862 eve.

● SHARP MZ80A 48k. Excellent condition. Built in monitor and cassette deck. Boxed including manuals and programs £190, or swap for Commodore 64, Spectrum or Atari. Tel: Barnsley 299715.

● APPLE II EUROPLUS. DOS 3.3 Disk Drive, Philips 12in green monitor, colour TV, hookup, Apple Silentype printer w/paper, manuals, games, £575 ono. Tel: Newmarket (0638) 662224.

● SHARP MZ80B, 64k. With Shap MZ80P5 printer, with database, account, stock control programs. Excellent condition, £350. Tel: Worthing 213063 (eve).

● TELETEXT UNIT. For BBC (neve used), £130. 35-track disc drive £50. Tel: Hemel Hempstead (0442) 212379.

● TRIUMPH ADLER 64k. PZ mini twin enclosed disc drives, including monitor and printer with Wordstar and Pakenorth programs. Little used, family present £585. Tel: Bernard (0203) 73302 on answercall if absent.

● APPLE SOFTWARE SALE. GPLE, Bag Of Tricks, Pascal, Multiplan, Hires Games, adventures, many more. Also DMSC 30 RGB colour card, unused. All originals with full documentation. Tel: Guildford (0483) 69975 eve.

● KODE 43 tele-printer keyboard, 132 column. Excellent working order and condition. Used with Sirius computer. Offers: Hunter Blair. Tel: Ross on Wye 62013.

● APPLE 2 plus clone. 64k enhanced keyboard, twin discdrives, Z80/CPM, RS232C, RF mod, 80 col cards. Prodos, Wordstar, DBase2, Cardbox, Visicalc, Musicmaker, copy programmes and Printshop, plus manuals, £450. Tel Kennedy 01-218 3439 (office).

● PENMAN for sale. 6 months old. Latest driver software £200 ono. Tel: Lorraine on (0693) 61121 after 6pm.

● ATARI 800 SYSTEM. Comprising 32k computer, disk drive, printer, data recorder, macro assembler, technical books, star raiders, typing tutor, games and diskettes, £495 the lot. Please Tel: High Wycombe 36445.

● MSX. SANYO MPC100 64k, 3½in Sony disk drive, data recorder, printer cable, games cassettes, and disks. Mint condition, £450 the lot. Please Tel: High Wycombe 36445 any time.

MICROCHESS

The Novag Super Constellation, accepted for a rating by the United States Chess Federation, took on David Welsh in a qualifying tournament. Kevin O'Connell describes the moves.

The World Chess Federation's debate about whether to allow a team of chess computers to play in the Chess Olympiad continued at the recent World Chess Federation congress at Graz in Austria. This debate has been going on, at temperatures varying from warm to very hot indeed, for more than four years. The computer team will, after all, take part — the computers don't need the money, but the World Chess Federation does.

Meanwhile, the US Chess Federation has started a Computer Rating Agency. The idea behind it is that the USCF, by playing many games against players of comparable strength under controlled tournament conditions, can develop a computer as accurate as the ratings of human players (all active players are rated, from the humblest up to the world champion).

The first program submitted to the US Chess Federation for rating was a chess machine, the Novag Super Constellation.

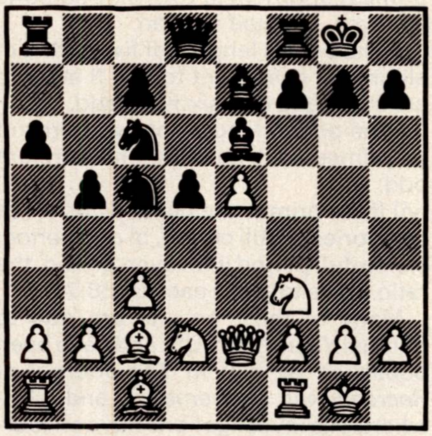
In a 40-game tournament against players rated between 1900 and 2100 (very strong club players who would make up the bulk of county second teams in the UK), the Super Constellation scored 22 points and acquired an official USCF rating of 2018. Here is one of the games from that tournament.

White: David Welsh. Black: Super Constellation. Spanish Opening.

1	e2-e4	e7-e5
2	Ng1-f3	Nb8-c6
3	Bf1-b5	a7-a6
4	Bb5-a4	Ng8-f6
5	0-0	Nf6xe4

(The Open Variation of the Spanish is quite a good choice for a program as it leads to active piece play for Black.)

6	d2-d4	b7-b5
7	Ba4-b3	d7-d5
8	d4xe5	Bc8-e6
9	c2-c3	Bf8-e7



Control over d4 is important

10	Nb1-d2	0-0
11	Qd1-e2	

(Less common than 11 Bb3-c2, but there is nothing wrong with this.)

11	...	Ne4-c5
12	Bb3-c2?	

(A natural enough move to preserve the light-square bishop, which can often be of great importance to White in this opening, but White should play 12 Nf3-d4, keeping control over the d4 square which is even more important.)

12	...	d5-d4!

(Now Black gets extremely active play.)

13	Nf3xd4	Nc6xd4
14	c3xd4	Qd8xd4
15	Nd2-f3	Qd4-c4
16	Rf1-e1	Qc4xe2

(When ahead it is a good idea to exchange pieces, and Black is significantly ahead in positional terms here.)

17	Re1xe2	Be6-c4
18	Re2-d2	Ra8-d8
19	b2-b3	Bc4-d5
20	Nf3-d4	Nc5-e6
21	Bc1-b2	Ne6xd4
22	Bb2xd4	Be7-b4
23	Rd2-d1	c7-c5

(Often in the Open Spanish, Black's only real problems are his backward c-pawn at c7 and a weak square on c5. In this game Black has none of those problems, having instead the signifi-

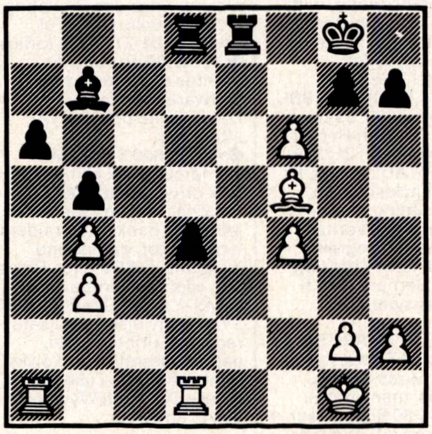
MICROCHESS

cant advantage of a good queen-side pawn majority (3-2).)

24 a2-a3 c5xd4
25 a3xb4 Bd5-b7

(The queen-side pawn majority has gone, but it has been replaced by a healthy passed d-pawn and the added benefit of crippled white queen-side pawns.)

26 Bc2-f5


The computer's task could be harder

(David Welsh, Chairman of the USCF Computer Chess Committee, was unhappy with this move, but White's position is terribly difficult now. 26 Bc2-d3, blockading the d-pawn, would have been a good deal better and would have made the computer's task much more difficult.)

26 ... Rf8-e8
27 f2-f4 f7-f6
28 e5xf6
28 ... Re8-e2!

(The Super Constellation has been playing excellent positional chess, and this is a very neat tactical point.)

29 Bf5-h3 g7xf6
30 Ra1-c1

(The culmination of White's plan, initiated by 26 Bc2-f5, of taking control of the c-file. Unfortunately it merely loses the exchange and the game. Both 30 Kg1-f1 and 30 Rd1-e1 would have been better.)

30 ... d4-d3!
31 Rc1-c7 d3-d2!
32 Kg1-f1

(32 Rc7xb7 loses horribly to 32. . .Re2-e1+.)

32 ... Rd8-e8
33 Rd1xd2

(There is no choice, but now White is helpless.)

33 ... Bb7xg2+
34 Bh3xg2 Re2xd2
35 Bg2-b7 Rd2-d4
36 Bb7xa6 Rd4xf4+
37 Kf1-g2 Rf4-g4+
38 Kg2-f3 Rg4xb4
39 Rc7-c3 Kg8-f7
40 Ba6-b7 Re8-e5
41 Rc3-d3 f6-f5
42 Bb7-d5+ Kf7-g6
43 h2-h3 Kg6-g5
44 Bd5-g8 h7-h5

(Black plays the ending surprisingly well for a program, and soon finishes off White in fine fashion.)

45 Rd3-d7 Re5-e8
46 Bg8-f7 Re8-c8
47 Rd7-d3 Rc8-c2
48 Kf3-g3 h5-h4+
49 Kg3-f3 Rc2-h2
0-1

(White resigns because he cannot defend the h-pawn.)

NUMBERS COUNT

Mike Mudge presents prime period lengths and some related conjectures.

The period length L(p) of a prime number p is defined to be the number of digits in the period, or repetend, of the decimal representation of a proper fraction whose denominator is p.

Therefore, L(3) = 1 because 1/3 = .333 . . . the period having one digit, namely 3. However, L(17) = 16 because 1/17 = .05882352941176470588235294117647 . . . or as one learnt at school 1/17 = .0588235294117647, the period having 16 digits.

Simple consideration of the division process and the remainders which arise at each stage will convince the reader that L(p) is less than p, and if L(p) = p − 1 the p is called a *full period prime*, for example 17, 19, 23, 29.

Results

1) L(p) divides p − 1, so that p is one greater than a multiple of L(p).
2) Every positive integer is the period length of, at most, a finite number of primes.
3) Every positive integer is the period length of at least one prime.
4) The period lengths of all primes congruent to 7, 11, 17, 19, 21, 23, 29 or 33 (modulo 40) are even, and divisible by the largest power of two that divides p − 1.
5) The period lengths of all primes congruent to 3, 27, 31 or 39 (modulo 40) are odd.
6) If p and 2p + 1 are both prime, and if 2p + 1 is congruent to 7, 19 or 23 (modulo 40) then L(2p + 1) = 2p.
7) If p and 2p + 1 are both prime, and if 2p + 1 is congruent to 3, 27 or 39 (modulo 40) then L(2p + 1) = p. (Recall that a is said to be congruent to b modulo c if, and only if, the difference between a and b is a multiple of c.)

Asymptotic conjectures

(i) Three-eighths of all primes are full period primes.
(ii) The period lengths of all primes are distributed evenly among the 16 possible residue classes modulo 40.
(iii) The period lengths of half of all primes congruent to 13 or 37 modulo 40 are even, and half are odd.
(iv) The period lengths of five-sixths of all primes congruent to 1 or 9 modulo are even, and one-sixth are odd.
(v) The period lengths of two-thirds of all primes are even, and one-third are odd.
(vi) If the primes are divided into three categories, a) full period, b) odd period, c) non-full period with even period, the ratio of the totals in each is 9:8:7.

Many of these results are due to Samuel Yates of the US, and have been published by him in *The Journal of Recreational Mathematics* and elsewhere. His investigations have encouraged numerous other empirical number theorists to investigate prime periods and to advance results equivalent to those presented here.

Readers are invited to submit their program listings for the determination of prime periods, and hence the examination of the above results and conjectures. Particular interest centres around the generalisation of this work to number bases other than 10.

These submissions, which should include hardware description, run times, any comments, and of course some specimen output, will be judged using suitably vague criteria. A prize will be awarded, by *PCW*, to the 'best' entry received at 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffordshire WV4 5NF (tel: (0902) 892141) by 1 February 1986.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided. Expanded reviews of previous problems together with, subject to the approval of the contributor, copies of detailed programs from the prize-winning entry may also be requested.

Prize-winner May

Some general introductory material relating to Euler's Totient function can be found, for example, in *A Pathway into Number Theory* by RP Burn, CUP 1982, or *An Introduction to the Theory of Numbers* by IM Vinogradov, transla-

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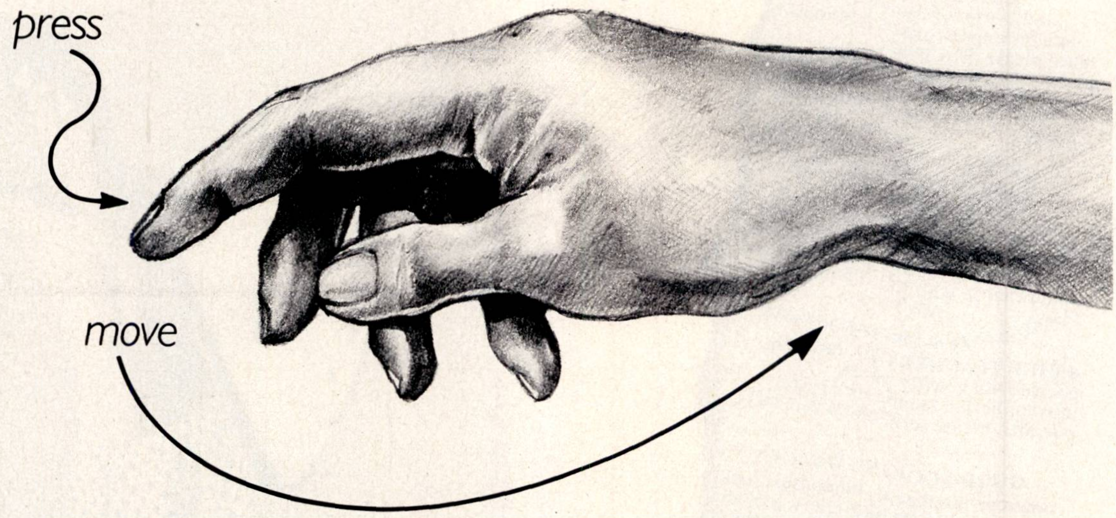

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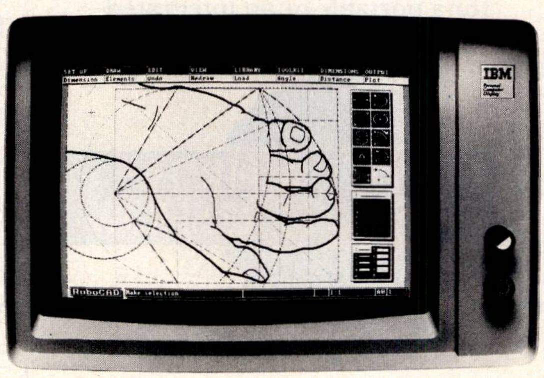

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END ZONE

NUMBERS COUNT

tion published through Pergamon Press 1955. Detailed references to numerical results are given in *A Handbook of Integer Sequences* by NJA Sloane, Academic Press 1973.

This month's prize-winner is Robin Merson of 2 Vine Close, Wrecclesham, Farnham, Surrey GU10 4TE (tel: Frensham 3587) whose achievements include the following:

(i) Solutions of phi(n) = phi(n + 1) from n = 8 up to n = 20171384 . . run time 16 days.
(ii) All nontotients less than 10^4, with verification of 210 less than 10^3 and 2627 less than 10^4.
(iii) All noncototients less than 30000.
(iv) Determination of s(k) up to s(43) = 12531330
(v) Print of nontotients $2^k m$ with k greater than 3 and m a product of at least three different primes up to 547872.
(vi) Numbers in arithmetic progression and having the same phi, including six in a row: 165488430, 165488460, 165488490, 165488520, 165488550 and 165488580, all with phi equal to 44130240.

LEISURE LINES

Brain-teasers from JJ Clessa

Quickie

Another old chestnut. There are eight pints of milk in a churn. Using a three-pint jug and a five-pint jug only, how can you measure four pints?

Prize puzzle

Find a nine-digit number which contains each of the digits 1-9, and which can be fractioned into three 3-digit numbers which between them also use all digits 1-9.

As this can be done in more ways than one, you must find:
(a) The smallest 9-digit number; and
(b) The largest 9-digit number
which meets the above criteria.

Answers on postcards please, or backs of envelopes, to reach us not later than 30 November 1985.

August prize puzzle

There were 230 entries with few incorrect solutions to the problem of the number which, when multiplied by 13 and divided by 11, gives the original number in reverse.

Many of you pointed out that zero was a solution — indeed, several people submitted zero as an entry, but I didn't allow it.

The answer I was seeking was 77319, and the winning entry came from FA Khatir of Dartmouth. Congratulations, your prize is on its way.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printer's errors, and so on.

Glasgow	Anderston Centre. Micro Computers & Software Show. Trade Exhibitions (0764) 4204	29-31 Oct
Peterborough	The Crescent Centre. East of England Computer Fair. Contact: Dave Stitcher (0733) 234540	11 Nov
London	Olympia. COMPEC 85. Contact: Mike Birch (01) 643 8040	12-15 Nov
London	New Horticultural Hall, London SW1. Electron & BBC User Show. Contact: Mike Cowley (061) 456 8383	14-17 Nov
London	Barbican Centre. Computers in the City. Contact: Online Conferences Ltd (01) 868 4466	18-22 Nov

WRITING FOR PCW

Your chance to contribute to the magazine.

We're offering readers the chance to get rich (well, at least richer) and to influence what's published in the magazine — by writing for it. We welcome approaches from would-be writers, including those who have never appeared in print before. It's often users with practical experience who have the most interesting things to say, so don't worry if your prose is less than perfect, we can take care of the polishing.

If you have an idea for a feature write, with a brief synopsis, outlining the proposed structure and content. If your article is already written, then send it in for consideration. Remember to put your name and address on both the covering letter and the manuscript — along with a daytime phone number if possible. Manuscripts should be typed or printed out (dot matrix output is fine), in double-line spacing with ample margins top and bottom and on each side.

We'll try to return all submissions sent in with a suitable sae, but make sure you keep a copy of everything you submit as well for reference.

Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well.

Bear in mind that it's worth taking a look at the Back Issues advertisement to see what sort of things we have already published — after all there's no point in reinventing the wheel. And please be sure to tell us if you've contacted another magazine (perish the thought): it would be very awkward if the same article appeared elsewhere. Frankly, we're more likely to accept something

KGB

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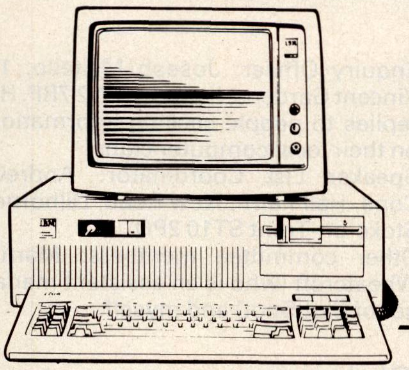

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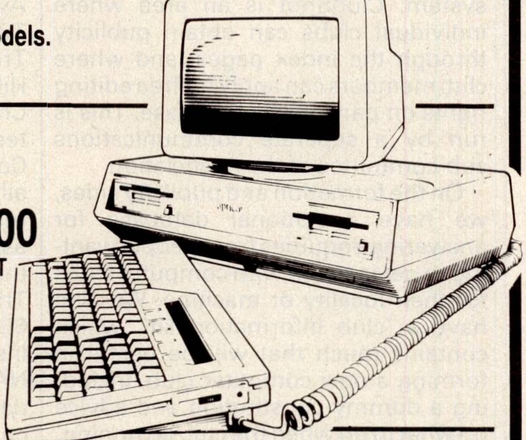

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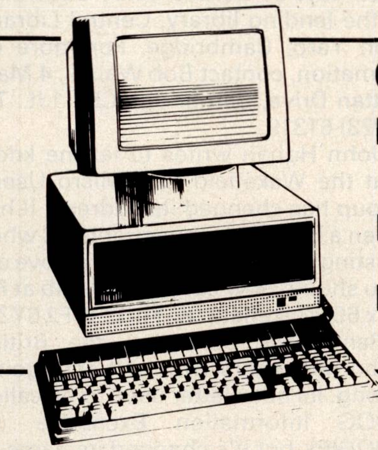

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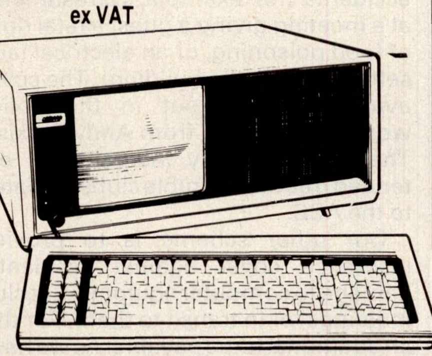

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WRITING FOR PCW

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ACC NEWS

Rupert Steele presents a who's who of the ACC, and introduces this month's club news

The activities of the Association of Computer Clubs are presently split into two main areas: helping clubs form, insure and publicise themselves; and our activities in communications where we run ClubSpot 810 on the Prestel system. ClubSpot is an area where individual clubs can obtain publicity through the index pages, and where club members can apply for free editing rights on parts of the database. This is run by a separate communications sub-committee of the Association.

On the formation and publicity sides, we have a national database for answering enquiries from people wanting to get in touch with computer clubs for their locality or machine. We also have a 'club information kit', which contains much that will be useful in forming a new computer club, including a dummy constitution and advice on what to do when the club is running.

There are two insurance schemes available to those clubs which are affiliated (that is, pay the annual membership fee of £7.50-£30 depending on the size of the club). The first is a public liability scheme which protects all eligible (most UK-based) computer clubs against claims for negligence from third parties, arising from various accidents (for example, refreshments at a meeting giving a guest a fatal dose of food poisoning, or an electrical fault setting light to the building). The cover available is set out in the policy wording, available from Andy Purkiss. The public liability insurance is extended *free* to all eligible clubs affiliated to the ACC.

Our other scheme is to provide insurance cover against accidental damage to computer equipment at club meetings, or in transit to them. For this an additional fee is payable. As we have had to move the policy to another insurer, Eagle Star, an increase in the fees is necessary.

The policy runs on a system of 'units'. Each unit insures £2000 worth of equipment that may be at a club meeting. The first unit costs £7.50 a year, and subsequent units cost £6.50. The minimum number of units is two, but you should have enough to cover the total new replacement value of all the equipment you are likely to have at a meeting. There is no need to specify the items in advance.

Who's who

Chairman: John Bone of Computer-Town! North East (and other clubs as well). If you can't get the answer from anyone else, or don't know who to ask, get in touch with John. His details are at the foot of the article.

Secretary: Jonathan Farmer, 35 Julian Avenue, Walkergate, Newcastle upon Tyne NE6 4KJ.

Treasurer: Philip Baron, 173 Knaves Hill, Leighton Buzzard, Beds.

Chairman of Club Liaison Subcommittee: Andrew Holliman of Haverhill Computer Club. Andrew is in charge of all club services, and has special responsibility for setting up regional associations of clubs and maintaining the ACC database. His address is 5 Trinity Close, Balsham, Cambridge CB1 6DW, or call him on (0223) 893983.

Insurance Coordinator: Andy Purkiss of NAMEBUG. He is the ACC's link man for dealing with the various insurance companies underwriting our schemes for clubs. He is the person to ask about whether your club qualifies for insurance, and should be contacted in the event of a claim. He's at 12 Palm Close, Witham, Essex or call (0376) 515609.

Minutes Secretary/Secretary of Club Liaison Committee: Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Wolverhampton, Staffs WV4 5NF.

Membership Secretary: Ken Bickley, 38 Envis Way, Guildford, Surrey GU3 3NH. Ken maintains our affiliation records, and registers clubs for membership.

Chairman of Communications Subcommittee: Peter Whittle, 9 Herschel Crescent, Littlemore, Oxford OX4 3TS.

Secretary of Communications Subcommittee: Andy Leeder, Church Farm, Stratton St Michael, Norwich NR15 2QB or (sys)tel (0508) 30355. Contact Andy if you would like to edit pages on ClubSpot on behalf of your club, or if you have any general enquiry about the ACC's ClubSpot activities.

Chief Manager of ClubSpot 810: Len Stuart of 89 Mayfair Avenue, Worcester Park, Surrey KT4 7SJ. Len is in charge of the day-to-day operation and development of ClubSpot 810. He is also involved with other communications ventures through the specialist group 'Netreach'. Tel: (01) 337 3747.

Exhibitions Secretary: Arranges the hobby presence at exhibitions which ask the ACC to coordinate the various club stands. This job has been very ably handled for some years by David Annal, who is also the creator of the Art Gallery feature on ClubSpot. His address is 142 Windermere Road, London SW16 5HE.

Enquiry Officer: Joseph Militello, 12 Vincent Gardens, London NW2 7RP. He replies to people seeking information on their local computer clubs.

Speaker List Coordinator: Andrew Cope, Hall Farm, New Road, Dilhorne, Stoke-on-Trent ST10 2PQ.

Other committee members: Martin Wheatcroft (who is an assistant manager of ClubSpot) and myself.

Club news

Thanks to Cambridge Computer Town for sending me a copy of its interesting newsletter, which includes a remarkably long list of sponsors including Sinclair Research and two Colleges (St John's and Downing) of Cambridge University. Its next two meetings are on Saturdays 26 October and 7 December at the lending library, Central Library, Lion Yard, Cambridge. For more information, contact Bob Waixel, 4 Manhattan Drive, Cambridge CB4 1JL. Tel (0223) 61319.

John Hoban writes to let me know that the Wakefield BBC Micro Users' Group has changed its address: it has taken a PO Box to save problems when existing committee members move on. You should now contact the club at PO Box 65, Wakefield, W Yorks WF2 6YZ.

Remember BOOG — the British Osborne Owners' Group? It is still going strong. Its newsletter used to be called BOOG Information Exchange (or BOOGIE), but it's changed its name to BOOGpaper although there doesn't seem to be any corresponding decrease in quality. The editor of BOOGpaper and secretary of BOOG is Gaynor Anglesea of Priory Cottage, Ardchattan Priory, Bonawe, Oban, Argyll PA37 1RQ, or you can call (0631) 75296. BOOGpaper may be published *in addition* to BOOGIE rather than instead of it. The group appears to be thriving and well worth joining if you have an Osborne.

For a mention in this column, to notify the ACC of a new or existing club, or to obtain club address labels: Rupert Steele, 12 Philbeach Gardens, London SW5 9DY.

Any other enquiry, including the address of your local club: John Bone, ACC chairman, 2 Claremont Place, Gateshead, Tyne & Wear NE8 1TL, or call (091) 477 0036. END

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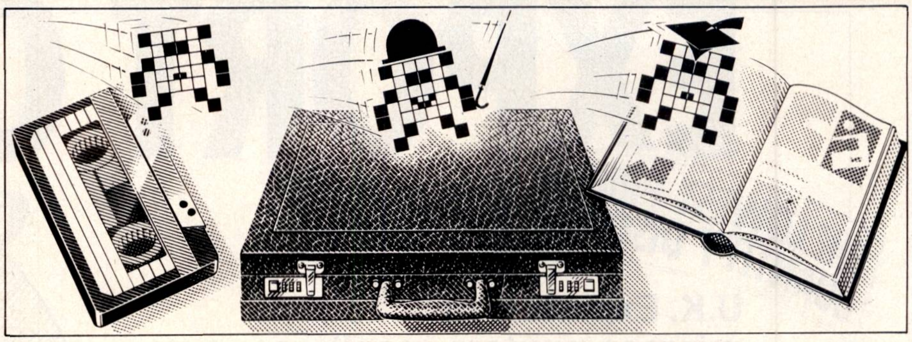

Owen Linderholm selects the best of readers' programs. For details on submitting your own, see the end of this section.

This month I've had a difficult time selecting the programs for Program File. The standard of the programs you send in goes up every month, but I would still like to see more original and carefully written, structured and documented programs. I finally chose an extremely short, efficient and enjoyable version of Q*bert for the BBC Micro as Program of the Month. You'll have a great time bouncing about dodging snakes and missiles, and changing colours all over the place. Spectrum owners also get a pleasant surprise this month. The power and ease of use of office technology finally arrives for the Spectrum with Spectrum Spreadsheet! This spreadsheet has all the functions and facilities a home user could want: complete formulae entry; printout of the spreadsheet; loading and saving often-used spreadsheets; a help facility, and many others.

Amstrad Amsquill is a powerful, fully featured word processor for the Amstrad CPC464, which would take little modification to work on the CPC664 or CPC6128. It has as many facilities as Amsword, although it is slower as it is written in Basic. For the Commodore 64, there is a utility to help debug programs. You can trace, step or walk through any Basic program you have written. The program uses a small text window to keep the tracing separate from the normal screen. For Oric fans who have been pining for support for their machines as the main base of Oric operations moves overseas, there is a powerful assembler with many facilities.

For the Memotech range of computers, there is a renumbering utility.

Games
Scientific/mathematic
Business
Toolkit/utilities
Educational/Computer Aided Learning

Program of the Month

BBC B*Bert

by Mohammed & Yusuf Ali

This is a version of the arcade game Q*bert and has the usual snake, plus a new monster, the Gback which flies down the side of the pyramid, firing energy rays as it goes. You must try to change the colour of the cubes to white by passing over them. Success means that you move on to harder levels. You have three lives. The controls for moving B*Bert are 1 for up and left, 4 for up and right, A for down and left and D for down and right. Don't stay on a cube for too long or you will slip off. Remember to avoid the murderous mutant snake!

The game uses fast multicoloured characters, similar to sprites, which are handled by a machine code routine. When loading the saved program from cassette, remember to type PAGE=&E00 before chaining it, or it won't run. Do not try running the program after you have typed it in until you have saved it.

PROGRAM FILE

```
10REM B*BERT
20REM * by M.Ali & Y.Ali *
30*FX200,1
40ENVELOPE3,1,20,10,-5,10,10,6,127,-120,0,-120,126,126
50SOUND 1,2,10,10
60ENVELOPE1,8,10,6,-1,0,0,255,109,-1,0,-1,126,126
70ENVELOPE2,1,-12,-6,-3,3,6,12,126,0,0,-126,126,126
80MODE7:PRINTTAB(14,12)CHR$(141);CHR$130"B*BERT":PRINTTAB(14,13)CHR$(141);CHR
$130"B*BERT"
90GOTO170
100DEFFNDT(N)
110FOR I=1 TO N
120READ D$
130DM=EVAL("&"+D$)
140?P%=DM:P%=P%+1
150NEXT
160=PASS
170DIM START 708
180FOR PASS=0 TO 2 STEP 2
190P%=START
200RESTORE
210[OPTPASS
220LDA #(S1 MOD 256):STA&7C:LDA #(S1 DIV 256):STA&7D:LDA #(S2 MOD 256):STA&7E:
LDA #(S2 DIV 256):STA&7F:LDA #(S3 MOD 256):STA&80:LDA #(S3 DIV 256):STA&81:LDA #
(S4 MOD 256):STA&88:LDA #(S4 DIV 256):STA&89:JSR CHAR1:RTS
230.SNAKE
240LDA&7E:STA&79:LDA&7F:STA&7A:LDX&84:LDY&85:JSRDR
250RTS
260.GBACK:LDA&80:STA&79:LDA&81:STA&7A:LDX&86:LDY&87:JSRDR:RTS
270.SHOT:LDA&88:STA&79:LDA&89:STA&7A:LDX&8A:LDY&8B:JSRDR:RTS
280.CHAR1 LDA&7C:STA&79:LDA&7D:STA&7A:LDX&82:LDY&83:JSRDR:RTS
290.DR STX&70:STY&71:LDY#0:LDA(&79),Y:STA&73:INY:LDA(&79),Y:STA&72:LDX#2
300.NR LDA#0:STA&7B:LDA&72:STA&74:JSR CAL
310.NC TXA:TAY:LDA(&79),Y:LDY&7B:EOR(&75),Y:STA(&75),Y:TYA:ADC#8:STA&7B:INX:DE
C&74:BNE NC:INC&71:DEC&73:BNE NR:RTS
320.CAL LDA#0:STA&78:STA&75:LDA&70:ASL A:ASL A:ROL&78:ASL A:ROL&78:STA&77:LDA&
71:AND #&F8:LSR A:LSR A:STA&76:LSR A:LSR A:ROR&75:ADC&76:TAY:LDA&71:AND#7:ADC&75
:ADC&77:STA&75:TYA:ADC&78:ADC#&30:STA&76:RTS
330.S1
340OPT FNDT(135)
350.S2
360OPT FNDT(97)
370.S3
380OPT FNDT(232)
390.S4
400OPT FNDT(37)
410]
420NEXT
430DATA13,7
440DATA0,11,33,22,0,0,0
450DATA0,33,22,11,0,0,0
460DATA11,33,11,33,0,0,0
470DATA11,33,37,3B,0,0,0
480DATA33,33,37,11,22,0,0
490DATA33,33,33,33,22,11,33
500DATA33,33,33,33,33,33,11
510DATA33,33,33,33,33,33,11
520DATA33,33,33,33,33,33,11
530DATA33,33,33,22,0,11,33
540DATA33,33,22,33,22,0,0
550DATA33,33,22,11,22,0,0
560DATA33,33,33,0,0,0,0
570DATA11,33,33,33,0,0,0
580DATA0,33,33,22,0,0,0
590DATA0,11,11,0,0,0,0
600DATA0,11,11,0,0,0,0
610DATA0,11,0,22,0,0,0
620DATA0,11,33,33,0,0,0
630DATA 13,5
640DATA0,54,AA,0,0
650DATA0,BF,54,0,0
660DATA0,FE,FE,AA,0
670DATA54,FE,FE,AA,0
680DATAFE,FE,FC,FE,0
690DATAFE,AA,54,FE,AA
700DATA0,0,54,FE,AA
710DATA0,0,FE,FE,0
720DATA0,0,FE,AA,0
730DATA0,54,FE,FE,0
740DATA0,FE,AA,0,0
750DATA0,FE,AA,0,0
760DATA0,54,FE,0,0
770DATA0,0,FE,AA,0
780DATA0,0,54,FE,0
790DATA0,54,0,FC,AA
800DATA0,A8,0,FC,AA
810DATA0,54,FE,FE,0
820DATA0,0,FE,AA,0
830DATA17,A,0,0,0,15,3F,3F,2A,0,0,0,0,15,3B,33,11,37,2A,0,0,0,15,3B,33,22,AA
,11,37,2A,0,0,3B,37,33,55,FF,11,3B,37,0,15,33,3B,33,55,7F,11,37,3B,2A,3B,33,33,3
3,55,FF,11,33,37,37,3B,33,33,22,AA,AA,AA,33,33,37,3B,33,33,22,FF,55,FF,11,33,37
840DATA15,33,33,55,FF,FF,AA,AA,33,2A,54,3F,33,55,FF,FF,AA,55,3F,A8,0,FC,3F,AA,
55,FF,0,3F,FC,0,0,FC,FC,3F,3F,3F,3F,FC,FC,0,0,54,FC,FC,FC,FC,FC,FC,A8,0,0,0,FC,F
C,BD,3F,FC,FC,0,0,0,54,0,FC,FC,FC,FC,0,A8,0,0,54,A8,0,FC,FC,0,54,A8,0
850DATA0,54,A8,0,0,0,54,A8,0,0,54,A8,0,0,0,54,A8,0,0,54,A8,0,0,0,0,54,A8,0
,0,0,A8,0,0,0,0,54,0,0,0,0,A8,A8,0,0,54,54,0,0,0,0,FC,BD,0,0,7E,FC,0,0,0,0,0,A8,
0,0,54,0,0,0
860DATA7,5,B9,A8,FC,0,0,54,76,33,A8,0,0,B9,54,76,54,0,54,A8,B9,FC,0,0,0,54,76,
0,0,0,0,76,0,0,0,54,FC
870VDU23,224,&60,&F1,&FF,&D1,&E0,&70,&40,&70
880Q%=3:SC=0:D1=10:FD1=10:DEL=50:FDEL=50
890?&86=24:?&87=20:?&8A=24:?&8B=34
900MODE2:VDU23;8202;0;0;0;
910VDU19,2,5;0;19,1,5;0;19,3,5;0;19,11,2;0;19,8,1;0;19,9,2;0;19,10,1;0;19,14,1
;0;19,15,2;0;
920FORN=1TO100:GCOL0,7:PLOT69,RND(1280),RND(1024):NEXT
930X%=42:Y%=190:X=640:Y=900:P=0:FO=0:FL=0
940K=1:FOR R=0 TO 7:A=X:FOR C=1 TO K:GCOL 0,4:MOVE X,Y:MOVE X-64,Y-32:PLOT 85,
X,Y-64:MOVE X+64,Y-32:PLOT 85,X,Y
950GCOL0,6:MOVE X-64,Y-32:DRAW X-64,Y-96:DRAW X,Y-128:DRAW X,Y-64:DRAWX-64,Y-3
2:MOVE X,Y-128:DRAW X+64,Y-96:PLOT85,X+64,Y-32:MOVE X,Y-64:PLOT85,X,Y-128:X=X+12
8:NEXT:X=A-64:Y=Y-96:K=K+1:NEXT
960?&84=X%-4:?&85=22:?&82=X%:?&83=Y%:CALL START:PRINTTAB(2,0);"SCORE:"SC:COLOU
R 5:PRINTTAB(12,0);STRING$(Q%,CHR$(224)):CALL SNAKE:CALL GBACK
970REPEAT:A%=X%:B%=Y%:Z=Q%:IF INKEY(-49) X%=X%-4:Y%=Y%-24 ELSE IF INKEY(-19) X
%=X%+4:Y%=Y%-24 ELSE IF INKEY(-66) X%=X%-4:Y%=Y%+24 ELSE IF INKEY(-51) X%=X%+4:Y
%=Y%+24
980IF ?&84=X% AND ?&85=Y% Q%=Q%-1:GOTO1040
990IF POINT(X%*16,1024-(Y%*4)-70)=0 THEN Q%=Q%-1:GOTO1040
1000IF A%<>X% OR B%<>Y% THEN PROCPA:?&82=A%:?&83=B%:CALLSTART:?&82=X%:?&83=Y%:C
ALLSTART:SIT=0 ELSE SIT=SIT+1
1010IF SIT=100 THEN Q%=Q%-1:GOTO1040
1020PROCSN:PROCV
1030IF FO=1 THEN PROCSHOT ELSE FORN=0 TO 30:NEXT
1040UNTIL Z<>Q% OR P=36
```

PROGRAM FILE

```
1050IF P=36 THEN FL=1
1060IF FL=1 AND DEL<>0 THEN DEL=DEL-10:FDEL=DEL:FD1=FD1-2:D1=D1-2:GOTO900 ELSE
IF FL=1 THEN GOTO 900
1070IF Q%<>0 THEN PROCDIE:GOTO900
1080PRINTTAB(12,0)"  ":PROCDIE
1090VDU5:GCOL0,14:MOVE200,700:PRINT"  Press space "'"       to start":GCOL0,15:M
OVE205,705:PRINT"  Press space "'"       to start":VDU4
1100IF INKEY(-99) THEN GOTO 880 ELSE GOTO 1100
1110DEFPROCPA
1120C%=X%*16+6:D%=1010-(Y%*4)
1130IF POINT(C%,D%-40)=4 THEN P=P+1:SC=SC+1:PRINTTAB(8,0);SC
1140GCOL0,7:MOVE C%+32,D%-16:MOVE C%-32,D%-48:PLOT 85,C%+96,D%-48:PLOT 85,C%+32
,D%-80
1150SOUND 2,3,22,2
1160ENDPROC
1170DEFPROCSN
1180IF TIME<FDEL THEN ENDPROC
1190FDEL=TIME+DEL
1200CALL SNAKE:R%=RND(2):IF R%=1 THEN ?&84=(?&84)+4:?&85=(?&85)+24 ELSE IF R%=2
THEN ?&84=(?&84)-4:?&85=(?&85)+24
1210IF ?&85=214 THEN ?&84=38:?&85=22:CALL SNAKE:ENDPROC
1220CALL SNAKE:ENDPROC
1230DEFPROCV
1240IF TIME<FD1 THEN ENDPROC
1250FD=TIME+D1
1260IF ?&86=3 THEN CALL GBACK:?&86=24:?&87=20:CALL GBACK:ENDPROC
1270CALL GBACK:?&86=(?&86)-1:?&87=(?&87)+6:CALLGBACK
1280IF FO=0 AND RND(2)=1 THEN FO=1:?&8A=?&86:?&8B=(?&87)+9:CALL SHOT:SOUND &11,
2,200,5
1290ENDPROC
1300DEFPROCDIE:SOUND1,1,10,20
1310CALL START
1320REPEAT:?&83=(?&83)+10:IF POINT((?&82)*16,1024-((?&83)*4))<>0 THEN CALL STAR
T:FORN=1TO20:NEXT:CALLSTART
1330UNTIL ?&83>230
1340ENDPROC
1350DEFPROCSHOT
1360CALL SHOT:?&8A=(?&8A)+2:?&8B=(?&8B)+16:IF POINT((?&8A)*16+80,1024-(?&8B*4)-
30)=5 OR POINT((?&8A)*16+80,1024-(?&8B*4)-30)=3 OR POINT((?&8A)*16+80,1024-(?&8B
*4)-30)=2 OR POINT((?&8A)*16+80,1024-(?&8B*4)-30)=1 THEN Q%=Q%-1:ENDPROC
1370CALL SHOT
1380IF?&8B>200 THEN FO=0:CALL SHOT
1390ENDPROC
```

Spectrum Spreadsheet

by Paul Buckland

This is a 16 column by 30 row spreadsheet. Approximately 140 formulae of up to 64 characters in length may be entered and can be applied to any of the numeric cells in the spreadsheet. All inputs including those for formulae are validated and the only error message which may appear is concerned with tape loading. The commands are as follows:

Symbol shift Q — quits when in input mode.

5,6,7,8 — these move the cursor (invisible) around the screen and the whole sheet.

E — data entry mode. Type in the data and press return. The cursor will move down one cell and wait for more data to be entered. This continues until the bottom of the sheet is reached or you quit. If you press ENTER only, then the cell will be left blank. If you press Symbol-shift-O, the column A (text labels) will be displayed on the screen. Symbol-shift-J allows you to move the cursor to another cell.

A — alter data mode. This allows you to make a single entry or change the value held in a cell. Symbol-shift-O also works in this mode.

F — allows you to enter a formula in the form of an arithmetic expression. An example formula would be B5+B6/B7*B8-B9, where B5 is the cell at row 5 and column B. This would assign the value of this expression to the cell the cursor is currently on. No answer is given if the result would be greater than 999999.99. Whenever the complete spreadsheet is recalculated, this formula is re-evaluated and the new result stored in the correct cell.

D — deletes the formula for the cell the cursor is on.

S — shows the formula for the cell the cursor is on.

L — lists all the formulae to the screen or a printer.

R — recalculates the spreadsheet after new data has been entered.

O — displays column A onscreen when it would normally be offscreen.

J — is used to move the cursor straight to a given cell. It is often the most convenient way of moving the cursor as the cursor is invisible.

M — puts or removes the months of the year at the top of the spreadsheet.

N — puts or removes a line on the same row as the cursor.

P — prints out part of the sheet or does a screen dump to a ZX printer.

X — loads a spreadsheet from tape. Pressing enter loads the first one found.

Z — saves a spreadsheet to tape. It is saved in two parts under a chosen name.

C — clears the entire sheet and starts again.

K — prints a list of the keys and their functions.

If an error should occur while using the spreadsheet, type GOTO help to restart without losing any data. Lines 2754, 2770, 2840, 2850, 2960 and 2961 can be changed to allow the spreadsheet to use microdrives. When you have typed in the program, GOTO9999 will save and verify the program.

PROGRAM FILE

```
 20 REM * SPREADSHEET
 40 REM * PAUL E BUCKLAND
 41 REM *
 45 REM * STARTED :10.01.84
 50 REM * COMPLETED :03.11.84
 70 REM * AMENDED 15.7.85
 80 CLS
 150 PRINT AT 0,10; PAPER 1; INK 7; BRIGHT 1;"SPREAD SHEET";AT 1,15;"BY";AT 2,8;
" PAUL E BUCKLAND"
 160 GO SUB 3100
 180 GO SUB 500
 182 GO TO 220
 185 FOR n=1 TO 250: NEXT n
 190 PRINT AT 20,0;"
    ": RETURN
 220 PRINT AT 19,0;"  Mode: Cursor                    "
 230 LET i$=INKEY$
 240 IF i$="" THEN  GO TO 230
 250 LET oy=cy
 270 IF i$="8" AND sx<(cols-9) THEN  LET cx=cx+10: LET sx=sx+10: IF cx>23 THEN
LET x=x+10: LET cx=23: GO SUB 500: GO TO 200
 280 IF i$="5" AND sx>4 THEN  LET cx=cx-10: LET sx=sx-10: IF cx<3 THEN  LET cx=3
: LET x=x-10: GO SUB 500: GO TO 200
 290 IF i$="6" AND sy<>rows THEN  LET cy=cy+1: LET sy=sy+1: IF cy>18 THEN  LET c
y=18: LET y=y+1: GO SUB 500: GO TO 200
 300 IF i$="7" AND sy<>1 THEN  LET cy=cy-1: LET sy=sy-1: IF cy<1+(4 AND sy<>cy)
THEN  LET cy=1+(4 AND sy<>cy): LET y=y-1: GO SUB 500: GO TO 200
 310 PRINT  PAPER 7; OVER 1;AT oy,2;"                              "; PAPER 7; O
VER 1; BRIGHT 1;AT cy,cx-1;"         "
 325 IF i$="S" THEN  GO SUB 1178
 330 IF i$="P" THEN  GO SUB 3850
 340 IF i$="R" THEN  GO SUB 1540: GO SUB 500
 345 IF i$="E" THEN  GO SUB 930: GO SUB 500: LET flag=0
 350 IF i$="A" THEN  GO SUB 1830: GO SUB 500
 360 IF i$="D" THEN  GO SUB 650
 370 IF i$="X" THEN  GO SUB 2900: GO SUB 500
 390 IF i$="J" THEN  GO SUB 1280: GO SUB 500
 400 IF i$="N" THEN  GO SUB 5000: GO SUB 190: GO SUB 500
 410 IF i$="K" THEN  GO SUB 8500: GO SUB 500
 420 IF i$="C" THEN  GO SUB 8000
 425 IF i$="O" THEN  GO SUB 840: PAUSE 1: PAUSE 0: LET flag=0: GO SUB 500
 430 IF i$="Z" THEN  GO SUB 2700: GO SUB 500
 435 IF i$="F" THEN  GO SUB 2000: GO SUB 500
 440 IF i$="L" THEN  GO SUB 725: GO SUB 500
 460 IF i$="M" THEN  GO SUB 5100: GO SUB 190: GO SUB 500
 480 GO TO 200
 520 PRINT  INVERSE 1;AT 0,0;f$(rows+1,x TO x+31)
 530 POKE 65441,x
 540 POKE 65404,0
 550 POKE 65418,4
 560 RANDOMIZE USR USR "a"
 570 POKE 65404,y+3
 580 POKE 65418,14
 590 RANDOMIZE USR USR "a"
 630 PRINT AT cy,cx-1; PAPER 7; BRIGHT 1; OVER 1;"         "
 640 RETURN
 650 IF sx<14 OR sy<5 THEN  RETURN
 655 PRINT AT 19,8;"Delete Formula"
 656 GO SUB 190
 657 GO SUB 1160
 658 IF NOT po THEN  GO SUB 190: PRINT AT 20,0;"No formula present to delete": G
O TO 710
 660 BEEP .1,10: GO SUB 190: PRINT AT 20,0;"Are you sure to delete ? Y or N"
 661 LET g$=INKEY$
 662 IF g$="N" THEN  GO TO 710
 663 IF g$<>"Y" THEN  GO TO 661
 680 IF po THEN  LET a$(1,po TO )=a$(1,po+5+len2 TO ): GO SUB 190: PRINT AT 20,0
;"Deleted": LET end=end-len2-5
 710 GO SUB 185
 720 RETURN
 725 IF a$(1,1)=" " THEN  BEEP .1,10: GO SUB 190: PRINT AT 20,0;"No formulae pre
sent": GO SUB 185: RETURN
 726 PRINT AT 19,8;"List Formulae": GO SUB 190: PRINT AT 20,0;"Print to Screen,
Printer or QuitPress S, P or Q"
 727 LET g$=INKEY$
 728 IF g$="P" THEN  LET printer=1
 729 IF g$="S" THEN  LET printer=0
 730 IF g$="Q" THEN  GO SUB 190: RETURN
 731 IF g$<>"P" AND g$<>"S" THEN  GO TO 727
 735 LET n=0
 737 CLS
 740 LET po=1
 750 LET len=VAL a$(1,po+3 TO po+4)
 754 IF printer THEN  LPRINT a$(1,po TO po+2);"=";a$(1,po+5 TO po+4+len)'
 755 IF NOT printer THEN  PRINT a$(1,po TO po+2);"=";a$(1,po+5 TO po+4+len)'
 756 LET n=n+1+(1 AND len>31)+(1 AND len>63)
 780 LET po=po+5+len
 790 IF po>=end THEN  GO TO 801
 795 IF n>18 AND NOT printer THEN  INPUT "": LET n=0: GO SUB 803
 800 GO TO 750
 801 IF printer  THEN  CLS : RETURN
 803 INPUT "": PRINT )1;"Press any key to continue": PAUSE 1: PAUSE 0
 804 CLS : INPUT "": RETURN
 840 PRINT AT 19,8;"Show Column 'A'"
 850 LET yc=0
 855 IF flag=1 THEN  LET flag=0: GO SUB 500: RETURN
 860 LET xpt=2+(10 AND cx=3)
 870 FOR r=y+4 TO y+17
 890 LET yc=yc+1
 900 IF r>4 THEN  PRINT AT yc+4,xpt;f$(r,3 TO 13)
 910 NEXT r
 911 LET flag=1
 920 RETURN
 960 IF f$(sy,sx)="_" THEN  BEEP .1,10: RETURN
 970 PRINT AT 19,8;"Data Entry"
1001 LET len=10
1004 FOR q=sy TO rows
1005 IF q=4 OR f$(sy,sx)="_" THEN  GO TO 1110
1006 LET m$=""+("Enter Text " AND (sx<14 OR sy<4))+("Enter Number " AND sx>=14 A
ND sy>4): LET low=48-(16 AND (sx<14 OR sy<4)): LET hi=57+(107 AND (sx<14 OR sy<4
))
1007 GO SUB 9000
1010 IF g$=";" THEN  GO SUB 850: GO TO 1000
1020 IF g$="<=" THEN  GO TO 1140
1030 IF g$="" THEN  GO TO 1090
1040 IF g$(1)="^" THEN  GO SUB 1300: GO SUB 500: GO TO 1000
1080 IF hi=57 THEN  GO SUB 8800: GO TO 1090
1085 LET f$(q,sx TO sx+8)="": LET f$(q,sx+(9-LEN g$) TO sx+8)=g$
1090 PRINT  PAPER 7; BRIGHT 1;AT cy,cx-1;f$(q,sx-1 TO sx+8)
1100 IF sy=rows THEN  GO TO 1145
1110 LET cy=cy+(1 AND cy<19): LET sy=sy+1: IF cy>18 THEN  LET cy=18: LET y=sy-17
: GO SUB 500: IF flag=1 THEN  LET flag=0: GO SUB 850
1120 PRINT  PAPER 7;AT cy-1,cx-1;f$(q,sx-1 TO sx+8); PAPER 7; BRIGHT 1;AT cy,cx-
1;f$(q+1,sx-1 TO sx+8)
```

MICROMART

PROGRAM FILE

```
1130 NEXT q
1145 LET i$=""
1155 RETURN
1160 LET po=1
1166 IF po>end THEN  LET po=0: RETURN
1167 LET len2=VAL a$(1,po+3 TO po+4)
1170 LET xx=((CODE a$(1,po)-64)*10+4)-10: LET xy=VAL a$(1,po+1 TO po+2)
1171 IF xx<>sx OR xy<>sy THEN  LET po=po+5+len2: GO TO 1166
1175 RETURN
1178 IF sx<14 OR sy<5 THEN  RETURN
1179 PRINT AT 19,8;"Show Formula": GO SUB 190: GO SUB 1160
1180 IF po THEN  PRINT AT 20,0;a$(1,po+5 TO po+4+len2)
1182 IF NOT po THEN  PRINT AT 20,0;"No formula present to show": GO SUB 185: RET
URN
1200 RETURN
1290 PRINT AT 19,8;"Cursor Jump"
1300 LET m$="Column Letter (A TO "+CHR$ (col+64)+")"
1302 LET len=2: LET hi=64+col: LET low=64
1303 GO SUB 9000
1304 IF g$=";" OR g$="^" THEN  GO TO 1303
1306 IF g$="" THEN  LET jx=1: GO TO 1350
1310 IF g$="<=" THEN  RETURN
1340 LET jx=CODE g$-64: IF jx<1 OR jx>col THEN  GO TO 1280
1350 LET sx=jx*10-6
1360 IF jx*10-4>x+31 THEN  LET cx=23: LET x=(jx*10+1)-30: GO TO 1411
1370 IF jx*10<x THEN  LET cx=3: LET x=jx-9+(9*jx): GO TO 1411
1380 LET cx=(jx-9+(jx*9)+3)-x
1411 LET m$="Row No (1 TO "+STR$ rows+")    ": LET hi=57: LET low=48: LET len=3
1412 GO SUB 9000
1430 IF g$=";" OR g$="^" THEN  GO TO 1303
1435 IF g$="" THEN  LET jy=1: GO TO 1460
1440 IF g$="<=" THEN  RETURN
1450 LET jy=VAL g$: IF jy<1 OR jy>rows THEN  GO TO 1411
1460 LET q=jy: LET io=sy: LET sy=jy
1470 IF jy>y+17 THEN  LET cy=18: LET y=jy-17: RETURN
1480 IF jy<(y+4) THEN  LET cy=1+(4 AND jy>4): LET y=jy-(4 AND jy>4): RETURN
1490 LET cy=cy-(io-jy)
1500 RETURN
1540 IF a$(1,1)=" " THEN  GO TO 725
1541 PRINT AT 19,8;"Re-Calculating Sheet"
1545 LET dbz=0
1550 LET po=1
1555 LET xx=((CODE a$(1,po)-64)*10+4)-10: LET xy=VAL a$(1,po+1 TO po+2): LET len
=VAL a$(1,po+3 TO po+4): LET s$=a$(1,po+5 TO po+4+len)
1560 LET po=po+5+len
1570 GO SUB 2100
1611 IF dbz THEN  GO TO 1630
1620 LET g$=STR$ VAL c$: GO SUB 8805
1630 IF po>=end THEN  RETURN
1700 GO TO 1555
1860 IF f$(sy,sx)="_" THEN  BEEP .1,10: RETURN
1870 PRINT AT 19,8;"Alter Data"
1871 LET len=10
1885 LET m$=""+("Enter Text " AND (sx<14 OR sy<4))+("Enter Number " AND sx>=14 A
ND sy>4): LET low=48-(16 AND (sx<14 OR sy<4)): LET hi=57+(107 AND (sx<14 OR sy<4
))
1888 GO SUB 9000
1889 IF g$="<=" OR g$="" THEN  RETURN
1890 IF g$="^" THEN  GO TO 1888
1900 IF g$=";" THEN  GO SUB 850: LET flag=0: GO TO 1880
1910 LET q=sx+1
1950 IF hi=57 THEN  GO SUB 8800: GO TO 1970
1960 LET f$(sy,sx TO sx+8)="": LET f$(sy,sx+(9-LEN g$) TO sx+8)=g$
1970 PRINT  PAPER 7; BRIGHT 1;AT cy,cx;f$(sy,sx TO sx+8)
1990 RETURN
2025 IF sx<14 OR sy<5 OR f$(sy,sx)="_" THEN  RETURN
2030 PRINT AT 19,8;"Formula Entry"
2035 LET dbz=0
2036 GO SUB 190
2040 GO SUB 2400
2041 IF LEN s$+end>alen THEN  GO SUB 190: PRINT AT 20,0;"No more room for formul
a": GO SUB 185: RETURN
2045 IF i$="<=" THEN  GO SUB 190: RETURN
2046 GO SUB 1160
2048 IF po THEN  LET a$(1,po TO )=a$(1,po+5+len2 TO ): LET end=end-len2-5
2050 LET a$(1,end+1 TO end+1+4+len)=CHR$ (64+(sx+6)/10)+STR$ sy+(" " AND sy<10)+
STR$ (len-1)+(" " AND len<10)+s$
2051 LET end=end+4+len
2052 LET xy=sy: LET xx=sx
2055 LET po=end
2056 GO SUB 1570
2085 RETURN
2120 LET a=1
2125 LET c$=""
2130 LET si=((CODE s$(a)-64)*10+4)-10
2140 LET sj=VAL s$(a+1 TO a+2)
2150 LET a=a+3
2155 IF a>LEN s$ THEN  LET x$="": GO TO 2170
2160 LET x$=s$(a)
2170 LET c$=c$+"VAL f$("+STR$ VAL "sj"+","+STR$ VAL "si"+" TO "+STR$ VAL "si+8"+
")"
2175 IF f$(sj,si)="_" THEN  LET dbz=1: RETURN
2180 IF x$="" THEN  RETURN
2185 IF x$="/" THEN  GO SUB 2356
2190 LET c$=c$+x$
2200 LET a=a+1
2210 GO TO 2130
2356 LET si=((CODE s$(a+1)-64)*10+4)-10
2357 LET sj=VAL s$(a+2 TO a+3)
2358 IF f$(sj,si)="_" THEN  LET dbz=1: RETURN
2359 IF VAL f$(sj,si TO si+8)=0 THEN  LET dbz=1
2366 RETURN
2400 LET sp=0: LET s$=""
2401 LET len=1
2405 PRINT  FLASH 1; PAPER 5;AT 20,0;">"
2406 PAUSE 1: PAUSE 0
2410 LET i$=INKEY$
2415 IF i$="" THEN  GO TO 2410
2416 IF i$="<=" THEN  RETURN
2417 IF i$=CHR$ 12 AND len<>1 THEN  LET s$=s$( TO LEN s$-1): PRINT AT 20,1;s$;"
": LET len=len-1: GO SUB 2520: GO TO 2470
2425 IF i$>CHR$ (col+64) OR i$<"B" THEN  GO TO 2410
2427 GO SUB 2590
2432 PAUSE 1: PAUSE 0
2435 LET i$=INKEY$
2436 IF i$="" THEN  GO TO 2435
2437 IF i$="<=" THEN  RETURN
2440 IF i$=CHR$ 12 THEN  LET s$=s$( TO LEN s$-1): PRINT AT 20,1;s$;" ": LET len=
len-1: GO TO 2406
2445 IF i$>"9" OR i$<"1" THEN  GO TO 2435
2450 GO SUB 2590
2452 PAUSE 1: PAUSE 0
2454 LET i$=INKEY$
2455 IF i$="" THEN  GO TO 2454
```

```
2456 IF'i$="<=" THEN  RETURN
2457 IF i$=CHR$ 12 THEN  LET s$=s$( TO LEN s$-1): PRINT AT 20,1;s$;" ": LET len=
len-1: GO TO 2432
2458 IF i$="+" OR i$="-" OR i$="*" OR i$="/" OR i$=CHR$ 13 THEN  LET s$=s$+" ":
LET len=len+1: GO TO 2467
2460 IF i$>"9" OR i$<"0" THEN  GO TO 2454
2465 GO SUB 2590
2467 LET num=VAL s$(len-2 TO )
2468 IF num<5 OR num>rows THEN  GO SUB 2600: GO TO 2410
2469 IF i$="+" OR i$="-" OR i$="*" OR i$="/" OR i$=CHR$ 13 THEN  GO TO 2490
2470 IF sp THEN  LET sp=0: GO TO 2452
2471 PAUSE 1: PAUSE 0
2472 LET i$=INKEY$
2474 IF i$="" THEN  GO TO 2472
2476 IF i$="<=" THEN  RETURN
2480 IF i$=CHR$ 12 THEN  LET s$=s$( TO LEN s$-1): PRINT AT 20,1;s$;" ": LET len=
len-1: GO TO 2452
2490 IF i$=CHR$ 13 THEN  GO SUB 190: RETURN
2491 IF len=64 THEN  GO TO 2472
2495 IF i$<>"-" AND i$<>"+" AND i$<>"/" AND i$<>"*" THEN  GO TO 2472
2500 GO SUB 2590
2510 GO TO 2406
2520 IF s$(LEN s$)=" " THEN  LET len=len-1: LET s$=s$( TO LEN s$-1): LET sp=1
2530 RETURN
2590 LET s$=s$+i$
2591 LET len=len+1
2592 PRINT AT 20,1;s$
2595 RETURN
2600 GO SUB 190: PRINT AT 20,0;s$(len-3 TO );" is not a numeric box ": GO SUB 18
5: PRINT AT 20,1; FLASH 1; PAPER 5;AT 20,0;">"
2610 LET s$=s$( TO len-4)
2615 PRINT AT 20,1;s$
2620 LET len=len-3
2630 RETURN
2720 PRINT AT 19,8;"Save Sheet"
2730 LET m$="Enter Filename "
2731 LET len=9: LET hi=164: LET low=32
2732 GO SUB 9000
2741 IF g$="" OR g$="=" OR g$="^" THEN  GO TO 2732
2750 IF g$="<=" THEN  RETURN
2751 LET f$(rows+1,1 TO 4)=STR$ end
2754 SAVE "1"+g$ DATA f$()
2770 SAVE "2"+g$ DATA a$()
2775 BEEP .1,10: PRINT AT 20,0;"Verify Data ?  Press Y or N"
2780 LET i$=INKEY$
2790 IF i$="N" THEN  GO SUB 190: GO TO 2875
2795 IF i$<>"Y" THEN  GO TO 2780
2796 GO SUB 190: PRINT AT 20,0;"Verifying Data"
2840 PRINT AT 20,15;: VERIFY "1"+g$ DATA f$()
2850 PRINT AT 20,15;: VERIFY "2"+g$ DATA a$()
2870 BEEP .1,10: GO SUB 190: PRINT AT 20,0;"Verified": GO SUB 185
2875 LET f$(31,1 TO 4)="    ": LET i$=""

2880 RETURN
2920 PRINT AT 19,8;"Load Sheet"
2930 LET m$="Enter Filename "
2931 LET hi=164: LET low=32: LET len=9
2932 GO SUB 9000
2941 IF g$="<=" THEN  RETURN
2945 IF g$="=" OR g$="^" THEN  GO TO 2932
2960 PRINT AT 20,15;: LOAD ("1"  AND g$<>"")+g$ DATA f$()
2961 PRINT AT 20,15;: LOAD ("2" AND g$<>"")+g$ DATA a$()
2965 LET end=VAL f$(rows+1,1 TO 4): LET f$(rows+1,1 TO 4)="    "
3010 GO SUB 190
3011 RETURN
3100 LET le=0: LET end=0
3109 LET oy=1: LET help=3790
3111 LET jx=1: LET jy=1
3113 LET sx=4: LET sy=1
3115 LET cx=3: LET cy=1
3116 LET y=1: LET x=1
3119 LET flag=0
3120 POKE 23658,8
3190 LET col=16: LET alen=9000: LET cols=163: LET rows=30
3200 POKE 65410,cols: POKE 65453,cols
3210 PRINT AT 8,10; PAPER 1; BRIGHT 1; INK 7;"PLEASE WAIT"
3250 DIM f$(rows+1,cols)
3270 DIM a$(1,alen)
3280 LET f$(rows+1,1 TO 3)="   "
3290 FOR n=4 TO cols STEP 10
3300 LET f$(rows+1,n TO n+9)="    "+CHR$ VAL "((n+6)/10)+64"+"     "
3310 NEXT n
3340 FOR n=1 TO 3: LET f$(n)="": NEXT n
3360 LET f$(5)=""
3365 FOR n=13 TO cols STEP 10
3370 LET f$(5,n TO )="      00.00"
3390 NEXT n
3400 FOR n=3 TO cols STEP 10: LET f$(4,n TO )="__________"
3410 NEXT n
3420 FOR n=5 TO rows
3430 LET f$(n,1 TO 3)=STR$ n: LET f$(n,3 TO )=" "+f$(5,4 TO )
3435 LET f$(n,13)="¦"
3440 NEXT n
3460 RETURN
3810 PAPER 7: BORDER 7: INK 0: FLASH 0: BRIGHT 0: CLS : LET flag=0: POKE 23658,8
: GO TO 180
3850 PRINT AT 19,8;"Print Sheet"
3860 BEEP .1,10: GO SUB 190: PRINT AT 20,0;"Print Screen, Part sheet or QuitPres
s S P or Q"
3865 LET g$=INKEY$
3870 IF g$="S" THEN  GO SUB 4060: RETURN
3880 IF g$="Q" THEN  GO SUB 190: RETURN
3890 IF g$<>"P" THEN  GO TO 3865
3901 GO SUB 190
3902 LET len=2: LET hi=col+64: LET low=64
3903 LET m$="Start Column. (A TO "+CHR$ hi+")"
3904 GO SUB 6000
3905 IF g$="<=" THEN  RETURN
3906 IF CODE g$-64<1 OR CODE g$-64>col THEN  GO TO 3904
3907 LET sc=CODE g$-64
3908 LET m$="Last Column. ("+CHR$ (sc+64)+" TO "+CHR$ (col+64)+" )"
3909 GO SUB 6000
3910 IF g$="<=" THEN  RETURN

3911 IF CODE g$-64<sc OR CODE g$-64>col THEN  GO TO 3909
3912 LET lc=CODE g$-64: LET len=3: LET hi=57: LET low=48
3913 LET m$="Start Row. (1 TO "+STR$ rows+")"
3914 GO SUB 6000
3915 IF g$="<=" THEN  RETURN
3916 IF VAL g$<1 OR VAL g$>rows THEN  GO TO 3914
3917 LET sr=VAL g$
3918 LET m$="Last Row. ("+STR$ sr+" TO "+STR$ rows+")"
3919 GO SUB 6000
3920 IF g$="<=" THEN  RETURN
3921 'IF VAL g$<sr OR VAL g$>rows THEN  GO TO 3918
3922 LET lr=VAL g$
```

PROGRAM FILE

```
3924 PRINT AT 21,0;CHR$ (sc+64);" To ";CHR$ (lc+64);" , ";sr;" To ";lr;" UK? pr
ess Y/N"
3925 LET g$=INKEY$
3926 IF g$="N" THEN  GO TO 3900
3927 IF g$<>"Y" THEN  GO TO 3925
3928 BEEP .1,10
3929 GO SUB 190
3931 LET sc=(sc-1)*10+4
3932 LET lc=lc*10+3
3933 PRINT AT 20,0;"Press Q to quit printing"
3934 LPRINT : LPRINT "          SPREADSHEET DUMP   "
3935 LPRINT "________________________________": LPRINT : LPRINT
3937 FOR m=sc TO lc STEP 30
3939 LET to=m+28+((lc-28)-m AND m+28>lc)
3940 LPRINT : LPRINT  INVERSE 1;TAB 3;f$(31,m TO to)
3950 FOR n=sr TO lr
3960 IF INKEY$="Q" THEN  GO SUB 190: RETURN
3970 IF n>4 THEN  LPRINT  INVERSE 1;n;
3971 IF n<10 THEN  LPRINT "■";
3972 IF n<5 THEN  LPRINT "■";
3980 LPRINT TAB 3;f$(n,m TO to)
4000 NEXT n
4010 NEXT m
4020 LPRINT : LPRINT : LPRINT
4030 GO SUB 190
4040 RETURN
4060 GO SUB 190
4065 LPRINT "           SCREEN DUMP           ": LPRINT "________________________
_______": LPRINT : LPRINT : COPY
4070 LPRINT : LPRINT : RETURN
5000 GO SUB 190
5001 IF sy=4 THEN  BEEP .1,10: RETURN
5010 BEEP .1,10: PRINT AT 20,0;"Put, Remove Line or Quit ?       Press P, R or Q"
5015 LET g$=INKEY$
5020 IF g$="R" THEN  GO SUB 5050: RETURN
5025 IF g$="Q" THEN  RETURN
5030 IF g$<>"P" THEN  GO TO 5015
5040 FOR n=3 TO cols STEP 10: LET f$(sy,n TO )="__________": NEXT n: LET f$(sy,1
3)="¦": RETURN
5050 IF sy<4  THEN  LET f$(sy)=""
5060 IF sy>4 THEN  FOR n=13 TO cols STEP 10: LET f$(sy,n TO )="      00.00": NEXT
 n: LET f$(sy,3 TO 13)="          ¦"
5080 RETURN
5100 GO SUB 190
5107 BEEP .1,10: PRINT AT 20,0;"Put, Remove Month or Quit ?      Press P, R or Q"
5110 LET g$=INKEY$
5120 IF g$="R" THEN  LET f$(1,14 TO 133)="": RETURN
5125 IF g$="Q" THEN  RETURN
5130 IF g$<>"P" THEN  GO TO 5110
5135 RESTORE 9597
5140 FOR n=14 TO 124 STEP 10: READ g$: LET f$(1,n TO n+9)="": LET f$(1,n+(9-LEN
g$) TO n+9)=g$: NEXT n
5150 RETURN
6000 GO SUB 9000
6010 IF g$=";" OR g$="" OR g$="^" THEN  GO TO 6000
6020 RETURN
8000 BEEP .1,10
8005 GO SUB 190: PRINT AT 20,0;"Are you sure to clear the sheet Press Y or N"
8010 LET g$=INKEY$
8020 IF g$="N" THEN  GO SUB 190: RETURN
8030 IF g$<>"Y" THEN  GO TO 8010
8040 CLS : GO SUB 3100: GO SUB 500: RETURN
8500 CLS : PRINT "Key   Function"
8510 PRINT '"R   Re-calculate sheet"'"E   Enter data"'"A   Alter data"'"F   Ente
r a formula"
8520 PRINT "C   Clear sheet"'"M   Put in months"'"N   Put line"'"O   Show column
 A"'"D   Delete a formula"'"L   List formulae"'"J   Cursor jump"
8525 PRINT "P   Printer options"'"X   Load"'"Z   Save"
8530 PRINT ''"Press any key to continue": PAUSE 1: PAUSE 0: RETURN
8800 IF g$(LEN g$)="-" OR g$( TO LEN g$)="-." THEN  LET g$="-0"
8801 LET xy=sy: LET xx=sx
8805 LET g$="0"+g$: LET g$=STR$ VAL g$
8806 IF VAL g$>999999 THEN  RETURN
8807 LET ppos=0: FOR n=1 TO LEN g$: IF g$(n)="." THEN  LET ppos=n
8810 NEXT n
8813 IF ppos<>0 THEN  LET g$=STR$ (INT ((VAL g$*100)+.5)/100)
8815 IF ppos=0 THEN  LET g$=g$+".00"
8820 IF ppos THEN  LET g$=g$+"00"( TO 2-(LEN g$-ppos))
8825 LET f$(xy,xx TO xx+8)="    00.00"
8830 LET f$(xy,xx+(9-LEN g$) TO xx+8)=g$
8840 RETURN
9000 GO SUB 190: BEEP .1,10: LET le=1: LET fs=0: LET s$=""
9003 LET len2=len: IF m$(7)="N" THEN  LET len=len-3
9004 PRINT AT 21,0;m$+"[ ";AT 21,LEN m$+len2;"]"
9005 LET e$=INKEY$
9006 IF e$="" THEN  GO TO 9005
9012 IF e$="<=" THEN  LET g$=e$: GO TO 9060
9013 IF e$="^" OR e$=";" THEN  LET g$=e$: GO TO 9060
9014 IF e$=("." AND fs=0 AND le<8 AND m$(7)="N") THEN  LET fs=fs+1: LET len=LEN
s$+4: GO TO 9025
9018 IF e$="-" AND le=1 THEN  GO TO 9025
9019 IF e$<>CHR$ 13 AND e$<>CHR$ 12 AND (CODE e$<low OR CODE e$>hi) THEN  GO TO
9005
9020 IF e$=CHR$ 13 THEN  GO TO 9050
9022 IF LEN s$>0 AND e$=CHR$ 12  THEN  IF s$(LEN s$)="." THEN  LET fs=0: LET len
=len2-3
9023 IF le>1 AND e$=CHR$ 12 THEN  LET le=le-1: LET s$=s$(1 TO LEN s$-1): GO TO 9
030
9024 IF e$=CHR$ 12 THEN  LET e$="": GO TO 9030
9025 IF le<len THEN  LET s$=s$+e$: LET le=le+1
9030 BEEP .005,10: PRINT AT 21,0;m$+"["+s$;: IF LEN s$<>len2-1 THEN  PRINT " "
9040 GO TO 9005
9050 LET g$=s$
9060 GO SUB 190
9070 LET len=len2
9075 RETURN
9597 DATA "JANUARY","FEBRUARY","MARCH","APRIL","MAY","JUNE","JULY","AUGUST","SEP
TEMBER","OCTOBER","NOVEMBER","DECEMBER"
9800 PAPER 7: INK 0: BORDER 7: CLS
9820 CLS : PRINT AT 8,10; PAPER 1; BRIGHT 1; INK 7;"PLEASE WAIT"
9825 LET x=0: RESTORE 9840
9830 FOR n=USR "a" TO USR "a"+138
9835 READ c$: POKE n,VAL c$: LET x=x+VAL c$: NEXT n
9836 IF x<>13569 THEN  CLS : PRINT "Error in data": STOP
9837 GO TO 80
9840 DATA "197","229","213","33","75","92","94","35","86","235","203","110","32"
,"91","203","118","40","78","203","126","40","74","126","254","198","32","69","1
75"
9850 DATA "50","60","92","17","8","0","25","62","4","254","0","40","8","17","0",
"0","25","61","195","125","255","6","0","14","0","197","229","62","20","215","62
","1","215","126","215","35","126","215","62","20","215"
9860 DATA "62","0","215","17","1","0","25","235","1","30","0","205","60","32","2
25","17","0","0","237","90","193","16","217","209","225","193","201","35","94","
35","86","25","35","195","98","255","203","118","40","18","203"
```

```
9870 DATA "126","40","7","17","19","0","25","195","98","255","17","6","0","25","
195","98","255","35","203","126","40","251","17","6","0","25","195","98","255"
9999 CLEAR : SAVE "SPREAD" LINE 9800: BEEP 1,20: VERIFY ""
```

Amstrad Amsquill

by Justin Moffitt

All the commands for this superb word processor are given below, before the listing. The second listing is a utility to transform program files which have been saved in ASCII format to the format used by Amsquill. These programs should have been saved with ',A' after the usual SAVE command. It cannot handle very large programs which may have to be split up.

```
Loading And Saving The Program

 Amsquill is a long program and therefore must be typed in carefully. The
program may be saved with the following line;
SPEED WRITE 1:SAVE "AMSQUILL 1.0" [ENTER]
The program is saved at super fast speed, loading is simple, press the [CTRL] &
small [ENTER], you will see RUN" come up on the screen, start you tape and
loading starts.

Features

 Amsquill operates an Epson FX-80 printer and a cassette or disc drive. The
program can be made to work with tapes if you have a disc system by adding !TAPE
to all the loading and saving options.

 Amsquill allows use of left and right margins, block movements and word
wrapping. For the forgetful among us there is a help page.

Margin Setting

 Two margins can be set, that is a left and a right magin. The margins are
preset to column 1 and column 80. Thus you have 80 columns of text on screen.
Everything considers the set margins including delete, insert and blocks.

Blocks

 Amsquill can delete, clear, copy and change the case of any block of text. The
blocks are from the left to right margins and from the top and bottom markers
that you set.

Cursor Movement

 The cursor can be moved in a variety of ways, to the start and end of lines, by
words and of course by characters. All movements are made by the cursor cluster
on the keyboard.
NOTE:A joystick may not be used to move the cursor.

Controlling The Printer

 There are a variety of things that you can do with a printer as listed.

Keys:-
On Off
A  P    Proportional
B  O    Elite
C  N    Double strike
D  M    Emphasised
E  L    Italics
F  K    Underline
G  J    Condensed
H  I    Enlarged
Q       Form Feed

 These codes may be mixed on one line. Only the part of the line typed on is
printed, so remember not to type over 40 characters in enlarged mode.

The Control Keys

Key  Used                   With              With
     alone                  [SHIFT]           [CTRL]

Esc  Calls the main menu.
Tab  Centres line.
Caps Makes all leters that                    Makes every key act as if
Lock you type capital.                        it were being pressed
     Eg. abc becomes ABC                      along with [SHIFT].
     Pressing this again                      Pressing these keys again
     will turn the feature                    will turn the feature off
     off again.                               again.
Copy Clears file if prompt
     is answered by Y for
     Yes.
Del  Deletes character                        Deletes a full line of
     under cursor.                            the text file.
Clr  Inserts space at                         Inserts a line of spaces
     cursor.                                  at the cursor.
A    a                      A                 Clear line to cursor.
B    b                      B                 Delete marked block of
                                              text.
C    c                      C                 Set right margin.
D    d                      D                 Clear line from cursor.
E    e                      E                 Right justify.
F    f                      F                 Convert marked block to
                                              lower case.
G    g                      G                 Clear marked block.
H    h                      H                 Convert marked block to
                                              upper case.
I    i                      I
J    j                      J                 Set start of block
                                              marker.
K    k                      K                 Clear block markers.
L    l                      L                 Set end of block
                                              marker.
M    m                      M
N    n                      N                 Copy marked block to
                                              cursor.
O    o                      O                 Scroll down line.
```

PROGRAM FILE

P	p	P	Scroll up line.
Q	q	Q	Left justify.
R	r	R	Prints CR character, this character tells Amsquill Edit where to end a program line.
S	s	S	Clears whole line.
T	t	T	Control character lock on/off. Capital letters will print graphics, which act as control characters.
U	u	U	Call HELP page.
V	v	V	
W	w	W	Centre line of text.
X	x	X	Clear the set margins.
Y	y	Y	Word wrap on/off.
Z	z	Z	Set left margin.

Main Menu Options

Amsquill has a large main menu, when the keys is pressed Amsquill will do what is called a main function.

Key	Notes
1	Returns to text.
2	Save file. The file is saved under the name that you gave it at the start of the program.
3	Load file. Here you must input a file name this is just like save. Read errors can occour.
4	Merge two files. Here the file from tape is added onto the end of the file in memory.
5	List text to printer (Epson Fx-80) as explained Page 01.
6	Change colours to any two seperate colours as "Master Colour Chart"
7	Save the program to tape/disc, it also clears the text file.
8	Exit program. Here the program is not lost, but allows errors to be corrected.

Garbage Collection

Amsquill like many other programs for the Amstrad stops for garbage collection about every 100 lines typed in. This is not a problem as you can still type during the few seconds of stillness.

Adding To Amsquill

Amsquill is a long program and cannot really be added to, there are only three main features missing, search and replace, search and delete and highlight. These are easily added using INSTR but the program then becomes too long for memory.

```
10 REM
20 REM      Amsquill 1.0
30 REM
40 REM (C)1985 Justin Moffitt
50 REM
60 REM Editor
70 INK 0,13:BORDER 13:INK 1,26:CALL &BFF9,&C9,&1CED,&CF00:SYMBOL AFTER 127:SYMBO
L 128,255,129,129,129,129,129,129,255:SYMBOL 170,0,3,51,99,254,96,48,0
80 SPEED KEY 10,1:KEY DEF 6,1,13,13,13:KEY DEF 16,1,233,233,237:KEY DEF 38,1,109
,77,169:KEY DEF 66,1,168,168,168:KEY DEF 68,1,23,23,23:KEY DEF 70,1,169,169,170:
KEY DEF 79,1,232,232,236
90 MODE 2:LOCATE 1,1:PRINT CHR$(150)STRING$(17,CHR$(154))CHR$(156)" "CHR$(150)ST
RING$(38,CHR$(154))CHR$(156)" "CHR$(150)STRING$(17,CHR$(154))CHR$(156)
100 LOCATE 1,2:PRINT CHR$(149)" A M S Q U I L L "CHR$(149)" "CHR$(149)SPC(38)CHR
$(149)" "CHR$(149)SPC(17)CHR$(149)
110 LOCATE 1,3:PRINT CHR$(147)STRING$(17,CHR$(154))CHR$(153)" "CHR$(147)STRING$(
38,CHR$(154))CHR$(153)" "CHR$(147)STRING$(17,CHR$(154))CHR$(153)
120 WINDOW #1,1,80,6,21:IF file=0 THEN 2300 ELSE 2330
130 LOCATE 23,2:PRINT SPACE$(8)"Line:"SPACE$(5)"Column:   ":LOCATE 1,5:PRINT "...
......1.........2.........3.........4.........5.........6.........7.........8":L
OCATE 64,2:PRINT SPACE$(15):LOCATE 64,2:PRINT I$
140 g$="OFF":h$="OFF":j$="OFF":k$="OFF":l%=1:c%=1:r%=1:lm%=1:rm%=80:ctrl=0:wrap=
0:cloc=0:sloc=0:POKE 46311,0:POKE 46312,0
150 LOCATE 1,23:PRINT STRING$(20,"_"):LOCATE 31,23:PRINT STRING$(20,"_"):LOCATE
61,23:PRINT STRING$(20,"_")
160 LOCATE 1,24:PRINT CHR$(24)" CONTROL LOCK : "g$" ":LOCATE 31,24:PRINT "   WOR
D WRAP : "h$"  ":LOCATE 61,24:PRINT "  Press CTRL and U  ";
170 PRINT " SHIFTED LOCK : "j$" ";:LOCATE 31,25:PRINT "   CAPS LOCK : "k$"  ";:L
OCATE 61,25:PRINT "       for HELP      "CHR$(24);
180 LOCATE lm%,22:PRINT CHR$(246):LOCATE rm%,22:PRINT CHR$(247)
190 IF ret=1 THEN 2470 ELSE LOCATE 36,2:PRINT l%:LOCATE 48,2:PRINT c%
200 LOCATE #1,c%,r%:PRINT #1,CHR$(24)MID$(text$(l%),c%,1)CHR$(24)
210 LOCATE 1,1:PRINT CHR$(21):a$="":WHILE a$="":a$=INKEY$:WEND:PRINT CHR$(6):LOC
ATE #1,c%,r%:PRINT #1,MID$(text$(l%),c%,1)
220 IF ctrl=1 THEN 2430
230 IF a$>CHR$(31) AND a$<CHR$(127) THEN 2200
240 IF a$=CHR$(13) OR a$=CHR$(241) OR a$=CHR$(245) THEN 1940
250 IF a$=CHR$(168) THEN 2460
260 IF a$=CHR$(224) THEN LOCATE 23,2:PRINT "   Clear present text file (Y/N)?":a
$="":WHILE a$<>"Y" AND a$<>"N":a$=INKEY$:a$=UPPER$(a$):WEND:IF a$="Y" THEN 2290
ELSE LOCATE 23,2:PRINT SPACE$(8)"LINE:      Column:"SPACE$(11):GOTO 190
270 IF a$=CHR$(246) THEN 1880
280 IF a$=CHR$(247) THEN 1820
290 IF a$=CHR$(240) OR a$=CHR$(244) THEN 2100
300 IF a$=CHR$(242) THEN 2130
310 IF a$=CHR$(243) THEN 2170
320 IF a$=CHR$(250) THEN c%=lm%:GOTO 190
330 IF a$=CHR$(251) THEN c%=rm%:GOTO 190
340 IF a$=CHR$(248) THEN l%=l%-r%+1:r%=1:c%=lm%:GOTO 190
350 IF a$=CHR$(249) THEN l%=l%+15-r%:r%=15:c%=rm%:GOTO 190
360 IF l%=tb% OR l%=bb% THEN 190
370 IF tb%>0 OR bb%>0 THEN 460
380 a=ASC(a$)
390 ON a GOTO 1650,1100,1690,1640,1560,1210,1180,1230,180,1490,1320,1430,180,990
,720,640,1560,470,1660,660,750,180,1750,1710,690,1670
400 IF a$=CHR$(169) THEN 480
410 IF a$=CHR$(170) THEN 550
420 IF a$=CHR$(232) THEN 1740
430 IF a$=CHR$(233) THEN 1720
440 IF a$=CHR$(236) THEN 580
450 IF a$=CHR$(237) THEN 510 ELSE GOTO 190
460 IF a$=CHR$(3) OR a$=CHR$(24) OR a$=CHR$(26) THEN 190 ELSE 380
470 a$=CHR$(170):GOTO 2200
480 IF cloc=0 THEN cloc=1:k$="ON ":POKE 46312,255:GOTO 500
490 cloc=0:k$="OFF":POKE 46312,0
500 LOCATE 46,25:PRINT CHR$(24)+k$+CHR$(24);:GOTO 190
510 FOR f=200 TO l%+1 STEP -1:MID$(text$(f),lm%,rm%-lm%+1)=MID$(text$(f-1),lm%):
NEXT:MID$(text$(l%),lm%)=SPACE$(rm%-lm%+1):WINDOW #2,lm%,rm%,r%+6,21:PRINT #2,CH
R$(11):LOCATE #1,1,r%:PRINT #1,text$(l%)text$(l%+1);:LOCATE 1,21:PRINT SPACE$(80
);
520 IF l%<=tb% AND l%<200 THEN tb%=tb%+1
530 IF l%<=bb% AND l%<200 THEN bb%=bb%+1
540 GOTO 190
```

PROGRAM FILE

```
550 IF sloc=0 THEN sloc=1:j$="ON ":POKE 46311,255:GOTO 570
560 sloc=0:j$="OFF":POKE 46311,0
570 LOCATE 17,25:PRINT CHR$(24)j$CHR$(24);:GOTO 190
580 FOR f=1% TO 199:MID$(text$(f),lm%,rm%-lm%+1)=MID$(text$(f+1),lm%):NEXT:MID$(
text$(200),lm%)=SPACE$(rm%-lm%+1):WINDOW #2,lm%,rm%,r%+6,21:LOCATE #2,1,21-r%:PR
INT #2:LOCATE #1,1,r%:PRINT #1,text$(1%):LOCATE #1,1,15:PRINT #1,text$(1%-r%+15)
590 IF 1%=tb% THEN tb%=0
600 IF 1%=bb% THEN bb%=0
610 IF 1%<tb% THEN tb%=tb%-1
620 IF 1%<bb% THEN bb%=bb%-1
630 GOTO 190
640 IF (1%-r%)+16=201 THEN 190
650 LOCATE #1,1,16:PRINT #1,CHR$(10):LOCATE #1,1,15:PRINT #1,text$(1%-r%+16):1%=
1%+1:GOTO 190
660 IF ctrl=0 THEN ctrl=1:g$="ON ":GOTO 680
670 ctrl=0:g$="OFF"
680 LOCATE 17,24:PRINT CHR$(24)g$CHR$(24):GOTO 190
690 IF wrap=0 THEN wrap=1:h$="ON ":GOTO 710
700 wrap=0:h$="OFF"
710 LOCATE 46,24:PRINT CHR$(24)h$CHR$(24):GOTO 190
720 IF 1%-r%=0 THEN 190
730 LOCATE #1,1,1:PRINT #1,CHR$(11):LOCATE #1,1,1:PRINT #1,text$(1%-r%):1%=1%-1
740 LOCATE 1,21:PRINT SPACE$(80):GOTO 190
750 LOCATE 23,2:PRINT "          Amsquill HELP page.          ":WINDOW #2,1,80,4,22
:CLS #2
760 g=1%-r%+1
770 WINDOW SWAP 2,0:PRINT STRING$(20,"_")SPC(10)STRING$(20,"_")SPC(10)STRING$(20
,"_")SPC(10)
780 LOCATE 1,2:PRINT CHR$(24)+"       BLOCKS       ":LOCATE 31,2:PRINT " CONTROL
 CHARACTERS ":LOCATE 61,2:PRINT "     SCROLLING     "CHR$(24)
790 LOCATE 1,4:PRINT "J. Set top marker.  "SPC(10)CHR$(135)"     Enlarged      "C
HR$(136)SPC(10)"O. Scroll down line.";
800 PRINT "L. Set end marker.  "SPC(10)CHR$(134)"    Condensed        "CHR$(137)SPC
(10)"P. Scroll up line."
810 PRINT "K. Reset markers.   "SPC(10)CHR$(133)"    Underline        "CHR$(138)SPC
(10)STRING$(20,"_");
820 PRINT "G. Clear block.     "SPC(10)CHR$(132)"     Italics         "CHR$(139)SPC
(10)CHR$(24)"      FORMATTING      "CHR$(24);
830 PRINT "H. Block to upper.  "SPC(10)CHR$(131)"    Emphasised      "CHR$(140)
840 PRINT "F. Block to lower.  "SPC(10)CHR$(130)"  Double strike    "CHR$(141)SPC
(10)"Q. Left justify."
850 PRINT "N. Copy block.      "SPC(10)CHR$(129)"       Elite        "CHR$(142)SPC
(10)"E. Right justify."
860 PRINT "B. Delete block.    "SPC(10)CHR$(128)"   Proportional    "CHR$(143)SPC
(10)"W. Centre line."
870 PRINT STRING$(20,"_")SPC(10)CHR$(144)"      Form feed      "SPC(10)STRING$(20,
"_");
880 PRINT CHR$(24)"    LINE EDITING    "CHR$(24)SPC(10)"T. Ctrl lock on/off."SPC
(10)CHR$(24)"       WORD WRAP      "CHR$(24);
890 PRINT SPC(30)STRING$(20,"_")
900 PRINT "d. Delete line.     "SPC(10)CHR$(24)"        MARGINS        "CHR$(24)SPC
(10)"Y. Word wrap on/off.";
910 PRINT "c. Insert line.     "SPC(40)STRING$(20,"_");
920 PRINT "S. Clear line.      "SPC(10)"Z. Set left margin. "SPC(10)CHR$(24)"
   MAIN MENU      "CHR$(24);
930 PRINT "A. Clear to start.  "SPC(10)"C. Set right margin."
940 PRINT "D. Clear to end.    "SPC(10)"X. Reset margins.   "SPC(10)"e. Call mai
n menu."
950 WINDOW SWAP 0,2:a$="":WHILE a$="":a$=INKEY$:WEND
960 CLS #2:FOR f=g TO g+14:LOCATE #1,1,f-g+1:PRINT #1,text$(f);:NEXT
970 LOCATE 23,2:PRINT "       Line:      Column:   ":LOCATE 1,5:PRINT ".........1
.........2.........3.........4.........5.........6.........7.........8"
980 LOCATE lm%,22:PRINT CHR$(246):LOCATE rm%,22:PRINT CHR$(247):GOTO 190
990 IF tb%=0 OR bb%=0 THEN 190
1000 h=1%+bb%-tb%:IF h>200 THEN h=201
1010 IF h=tb% THEN 190
1020 IF h>tb% THEN IF h<bb% THEN 190
1030 IF 1%>tb% THEN IF 1%<bb% THEN 190
1040 MID$(text$(1%),lm%,rm%-lm%+1)=tb$+MID$(text$(tb%),lm%+1):MID$(text$(h),lm%)
=MID$(text$(bb%),lm%,rm%-lm%)+bb$
1050 FOR f=1%+1 TO h-1:MID$(text$(f),lm%,rm%-lm%+1)=MID$(text$(tb%+f-1%),lm%):NE
XT
1060 MID$(text$(tb%),lm%,1)=CHR$(245):MID$(text$(bb%),rm%,1)=CHR$(244)
1070 h=r%+bb%-tb%+1:IF h>15 THEN h=15
1080 g=r%-1:IF g<1 THEN g=1
1090 FOR f=g TO h:LOCATE #1,lm%,f:PRINT #1,MID$(text$(1%-r%+f),lm%,rm%-lm%+1):NE
XT:GOTO 190
1100 IF tb%=0 OR bb%=0 THEN 190
1110 FOR f=tb% TO 200-(bb%-tb%):MID$(text$(f),lm%,rm%-lm%+1)=MID$(text$(f+bb%-tb
%+1),lm%):NEXT:FOR f=201-(bb%-tb%+1) TO 200:MID$(text$(f),lm%)=SPACE$(rm%-lm%+1)
:NEXT
1120 tb$=MID$(text$(tb%),lm%,1):bb$=MID$(text$(bb%),rm%,1):MID$(text$(tb%),lm%,1
)=CHR$(245):MID$(text$(bb%),rm%,1)=CHR$(244)
1130 FOR f=1 TO 15:IF 1%-r%+f=tb% THEN 1170 ELSE NEXT
1140 IF tb%<1%-r%+1 THEN 1160
1150 GOTO 190
1160 f=1
1170 FOR g=f TO 15:LOCATE #1,lm%,g:PRINT #1,MID$(text$(1%-r%+g),lm%,rm%-lm%+1):N
EXT:GOTO 190
1180 IF tb%=0 OR bb%=0 THEN 190
1190 MID$(text$(tb%),lm%+1)=SPACE$(rm%-lm%):MID$(text$(bb%),lm%)=SPACE$(rm%-lm%)
1200 tb$=" ":bb$=" ":FOR f=tb%+1 TO bb%-1:MID$(text$(f),lm%)=SPACE$(rm%-lm%+1):N
EXT:GOTO 1250
1210 IF tb%=0 OR bb%=0 THEN 190
1220 tb$=LOWER$(tb$):bb$=LOWER$(bb$):FOR f=tb% TO bb%:MID$(text$(f),lm%)=LOWER$(
MID$(text$(f),lm%,rm%-lm%+1)):NEXT:GOTO 1250
1230 IF tb%=0 OR bb%=0 THEN 190
1240 tb$=UPPER$(tb$):bb$=UPPER$(bb$):FOR f=tb% TO bb%:MID$(text$(f),lm%)=UPPER$(
MID$(text$(f),lm%,rm%-lm%+1)):NEXT
1250 FOR f=1 TO 15:IF 1%-r%+f=tb% THEN 1290 ELSE NEXT
1260 IF tb%<1%-r%+1 THEN 1280
1270 GOTO 190
1280 f=1
1290 FOR g=1 TO 15:IF 1%-r%+g=bb% THEN 1310 ELSE NEXT
1300 g=15
1310 FOR h=f TO g:LOCATE #1,1,h:PRINT #1,text$(1%-r%+h):NEXT:GOTO 190
1320 IF bb%=0 AND tb%=0 THEN 190
1330 IF tb%>0 THEN 1360
1340 IF bb%>0 THEN 1380
1350 GOTO 1400
1360 MID$(text$(tb%),lm%,1)=tb$:FOR f=1 TO 15:IF 1%-r%+f=tb% THEN 1410 ELSE NEXT
1370 GOTO 1340
1380 MID$(text$(bb%),rm%,1)=bb$:FOR g=1 TO 15:IF 1%-r%+g=bb% THEN 1420 ELSE NEXT
1390 GOTO 1350
1400 bb%=0:tb%=0:tb$="":bb$="":GOTO 190
1410 LOCATE #1,lm%,f:PRINT #1,tb$:GOTO 1340
1420 LOCATE #1,rm%,g:PRINT #1,bb$:GOTO 1350
1430 IF tb%>1% THEN 190
1440 IF bb%>0 THEN 1460
1450 bb%=1%:bb$=MID$(text$(1%),rm%,1):LOCATE #1,rm%,r%:PRINT #1,CHR$(244):MID$(t
ext$(1%),rm%,1)=CHR$(244):GOTO 190
1460 FOR f=1 TO 15 STEP 1:IF 1%-r%+f=bb% THEN 1480 ELSE NEXT
1470 MID$(text$(bb%),rm%,1)=bb$:GOTO 1450
1480 LOCATE #1,rm%,f:PRINT #1,bb$:MID$(text$(1%-r%+f),rm%,1)=bb$:GOTO 1450
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PROGRAM FILE

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1490 IF bb%=0 THEN 1510
1500 IF bb%<1% THEN 190
1510 IF tb%>0 THEN 1530
1520 tb%=1%:tb$=MID$(text$(1%),lm%,1):LOCATE #1,lm%,r%:PRINT #1,CHR$(245):MID$(t
ext$(1%),lm%,1)=CHR$(245):GOTO 190
1530 FOR f=1 TO 15 STEP 1:IF 1%-r%+f=tb% THEN 1550 ELSE NEXT
1540 MID$(text$(tb%),lm%,1)=tb$:GOTO 1520
1550 LOCATE #1,lm%,f:PRINT #1,tb$:MID$(text$(1%-r%+f),lm%,1)=tb$:GOTO 1520
1560 IF MID$(text$(1%),lm%,rm%-lm%)=SPACE$(rm%-lm%) THEN 190
1570 FOR f=lm% TO rm%:IF MID$(text$(1%),f,1)=" " THEN NEXT ELSE 1580
1580 FOR g=rm% TO lm% STEP -1:IF MID$(text$(1%),g,1)=" " THEN NEXT ELSE 1590
1590 h=g-f+1:IF h=rm%-lm%+1 THEN 190
1600 IF a$=CHR$(17) THEN 1630
1610 cen$=MID$(text$(1%),f,h):MID$(text$(1%),f,h)=SPACE$(rm%-lm%):h=rm%-LEN(cen$
):MID$(text$(1%),h+1,LEN(cen$))=cen$:c%=rm%+1:LOCATE #1,1,r%:PRINT #1,text$(1%)
1620 IF c%>rm% THEN 1810 ELSE 190
1630 cen$=MID$(text$(1%),f,h):MID$(text$(1%),f,h)=SPACE$(rm%-lm%):MID$(text$(1%)
,lm%,LEN(cen$))=cen$:c%=lm%+LEN(cen$):LOCATE #1,1,r%:PRINT #1,text$(1%):GOTO 162
0
1640 MID$(text$(1%),c%)=SPACE$(rm%-c%+1):LOCATE #1,1,r%:PRINT #1,text$(1%):GOTO
190
1650 MID$(text$(1%),lm%)=SPACE$(c%-lm%+1):LOCATE #1,1,r%:PRINT #1,text$(1%):GOTO
 190
1660 MID$(text$(1%),lm%)=SPACE$(rm%-lm%+1):LOCATE #1,1,r%:PRINT #1,text$(1%):GOT
O 190
1670 IF c%=rm% THEN 190
1680 LOCATE lm%,22:PRINT " ":lm%=c%:GOTO 180
1690 IF c%=lm% THEN 190
1700 LOCATE rm%,22:PRINT " ":rm%=c%:GOTO 180

1710 LOCATE 1,22:PRINT SPACE$(80):lm%=1:rm%=80:GOTO 180
1720 IF MID$(text$(1%),rm%,1)=" " THEN 1730 ELSE 190
1730 g=rm%-c%:MID$(text$(1%),c%+1,g)=MID$(text$(1%),c%):MID$(text$(1%),c%)=" ":L
OCATE #1,1,r%:PRINT #1,text$(1%):GOTO 190
1740 g=rm%-c%:MID$(text$(1%),c%,g)=MID$(text$(1%),c%+1):MID$(text$(1%),rm%,1)="
":LOCATE #1,1,r%:PRINT #1,text$(1%):GOTO 190
1750 IF MID$(text$(1%),lm%,rm%-lm%)=SPACE$(rm%-lm%) THEN 190
1760 FOR f=lm% TO rm%:IF MID$(text$(1%),f,1)=" " THEN NEXT ELSE 1770
1770 FOR g=rm% TO lm% STEP -1:IF MID$(text$(1%),g,1)=" " THEN NEXT ELSE 1780
1780 h=g-f+1:IF h>rm%-lm%-1 THEN 190
1790 cen$=MID$(text$(1%),f,h):MID$(text$(1%),f,h)=SPACE$(rm%-lm%):h=((lm%+rm%)/2
)-(LEN(cen$)/2):MID$(text$(1%),h,LEN(cen$))=cen$:c%=h+LEN(cen$):LOCATE #1,1,r%:P
RINT #1,text$(1%)
1800 IF c%>rm% THEN 1810 ELSE 190
1810 a$=CHR$(13):GOTO 1940
1820 FOR f=c%+1 TO rm%:IF MID$(text$(1%),f,1)=" " THEN 1830 ELSE NEXT:GOTO 1840
1830 c%=f:GOTO 190
1840 c%=lm%-1:1%=1%+1:r%=r%+1:IF 1%=251 THEN 1870
1850 IF r%>15 THEN 1860 ELSE 1820
1860 LOCATE #1,1,16:PRINT #1,CHR$(10):LOCATE #1,1,15:PRINT #1,text$(1%):r%=15:GO
TO 1820
1870 1%=200:r%=r%-1:c%=rm%:GOTO 190
1880 FOR f=c%-1 TO lm% STEP -1:IF MID$(text$(1%),f,1)=" " THEN 1890 ELSE NEXT:GO
TO 1900
1890 c%=f:GOTO 190
1900 c%=rm%+1:1%=1%-1:r%=r%-1:IF 1%=0 THEN 1930
1910 IF r%<1 THEN 1920 ELSE 1880
1920 LOCATE #1,1,1:PRINT #1,CHR$(11):LOCATE #1,1,1:PRINT #1,text$(1%):r%=1:LOCAT
E 1,21:PRINT SPACE$(80):GOTO 1880
1930 r%=1:1%=1:c%=lm%:GOTO 190
1940 IF a$=CHR$(13) THEN c%=lm%
1950 IF 1%=200 THEN 190
1960 1%=1%+1:r%=r%+1:IF r%>15 THEN 2080
1970 IF lw=1 THEN 1990
1980 IF lw=1 THEN 2160 ELSE 190
1990 LOCATE #1,lm%,r%:PRINT #1,CHR$(24)MID$(text$(1%),lm%,1)CHR$(24)
2000 a$="":WHILE a$="":a$=INKEY$:WEND
2010 IF a$>CHR$(32) AND a$<CHR$(127) THEN 2030
2020 lw=0:GOTO 1980
2030 FOR f=rm% TO lm% STEP -1:IF MID$(text$(1%-1),f,1)=" " THEN 2040 ELSE NEXT
2040 IF f=lm% OR f=lm%-1 OR f=rm% THEN 1980
2050 f=f+1:MID$(text$(1%),lm%)=MID$(text$(1%-1),f,rm%+1-f):MID$(text$(1%-1),f)=S
PACE$(rm%+1-f)
2060 LOCATE #1,1,r%-1:PRINT #1,text$(1%-1)text$(1%);
2070 c%=lm%+(rm%+1-f):GOTO 1980
2080 LOCATE #1,1,16:PRINT #1,CHR$(10):LOCATE #1,1,15:PRINT #1,text$(1%):r%=15
2090 IF lw=1 THEN 1970 ELSE 190
2100 IF 1%=1 THEN 190
2110 1%=1%-1:r%=r%-1:IF r%<1 THEN 2120 ELSE 190
2120 LOCATE #1,1,1:PRINT #1,CHR$(11):LOCATE #1,1,1:PRINT #1,text$(1%):r%=1:LOCAT
E 1,21:PRINT SPACE$(80):GOTO 190
2130 IF 1%=1 AND c%=lm% THEN 190
2140 c%=c%-1:IF c%=lm%-1 THEN 2150 ELSE 190
2150 c%=rm%:GOTO 2110
2160 lw=0:GOTO 220
2170 IF 1%=200 AND c%=rm% THEN 190

2180 c%=c%+1:IF c%=rm%+1 THEN 2190 ELSE 190
2190 a$=CHR$(13):GOTO 1940
2200 IF MID$(text$(1%),c%,1)=CHR$(245) OR MID$(text$(1%),c%,1)=CHR$(244) THEN 22
60
2210 MID$(text$(1%),c%,1)=a$:LOCATE #1,c%,r%:PRINT #1,a$
2220 a$=CHR$(13):c%=c%+1:IF c%=rm%+1 THEN 2230 ELSE 190
2230 IF wrap=1 THEN lw=1
2240 IF 1%<200 THEN c%=rm%:GOTO 1940
2250 c%=rm%:GOTO 190
2260 IF MID$(text$(1%),c%,1)=CHR$(245) THEN 2280
2270 bb$=a$:GOTO 2220
2280 tb$=a$:GOTO 2220
2290 file=0:WINDOW #2,1,80,5,25:CLS #2
2300 CLEAR:CALL &BFF9,&C9,&1CED,&CF00
2310 l=2:c=34:le=15:LOCATE 23,2:PRINT "Filename ?"SPC(24):GOSUB 2340:IF i$="" TH
EN 2310
2320 file=1:DIM text$(201):FOR f=1 TO 201:text$(f)=SPACE$(80):NEXT:GOTO 130
2330 FOR f=1 TO 15:LOCATE #1,1,f:PRINT #1,text$(f):NEXT:GOTO 130
2340 i$="":POKE 46311,0:POKE 46312,255:FOR g=1 TO le+2:LOCATE c,l:PRINT "_"
2350 a$="":WHILE a$="":a$=INKEY$:WEND
2360 IF a$=CHR$(13) THEN 2420
2370 IF a$=CHR$(232) THEN 2400
2380 IF g=le+1 OR a$>CHR$(126) OR a$<CHR$(32) THEN 2350
2390 LOCATE c,l:PRINT a$;"_":c=c+1:i$=i$+a$:NEXT
2400 IF g=1 THEN 2350
2410 LOCATE c-1,l:PRINT "_ ":g=g-1:c=c-1:i$=LEFT$(i$,g-1):GOTO 2350
2420 LOCATE c,l:PRINT " ":RETURN
2430 IF ASC(a$)>64 AND ASC(a$)<82 THEN 2440 ELSE 230
2440 h=ASC(a$)+63:a$=CHR$(h):GOTO 2200
2450 REM Prints Main Menu
2460 ret=1:GOTO 1320
2470 ret=0:SPEED WRITE 1
2480 MODE 1:POKE 46311,0:LOCATE 14,2:PRINT CHR$(150)STRING$(12,CHR$(154))CHR$(15
6):LOCATE 14,3:PRINT CHR$(149)"AMSQUILL 1.0"CHR$(149):LOCATE 14,4:PRINT CHR$(147
)STRING$(12,CHR$(154))CHR$(153)
2490 LOCATE 1,7:PRINT "1"+STRING$(22,".")"Return to editing":PRINT "2"STRING$(22
,".")"Save text to tape":PRINT "3"STRING$(20,".")"Load text from tape":PRINT "4"
STRING$(19,".")"Merge text from tape"
2500 PRINT "5"STRING$(19,".")"List text to printer":PRINT "6"STRING$(25,".")"Cha
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nge colours":PRINT "7"STRING$(27,".")"Save program":PRINT "8"STRING$(26,".")"Exi
t to Basic"
2510 WINDOW #7,1,40,24,24:CLS #7:PRINT #7,SPC(12)"Press key  (1-8)"
2520 a$="":WHILE a$<CHR$(49) OR a$>CHR$(56):a$=INKEY$:WEND:a=VAL(a$):ON a GOTO 9
0,2530,2560,2640,2710,2800,2620,2630
2530 IF file=0 THEN 2510
2540 PRINT #7,"Please wait a moment":WINDOW #6,1,1,1,1:l%=0:c%=0:a$="":r%=0:tb$=
"":bb$="":tb%=0:bb%=0:rm%=0:lm%=0:ctrl=0:wrap=0:cloc=0:sloc=0:g$="":h$="":PRINT
#6,FRE(""):FOR f=200 TO 1 STEP -1:IF text$(f)=SPACE$(80) THEN NEXT
2550 IF file=0 THEN 2510 ELSE WINDOW SWAP 0,7:OPENOUT i$:FOR g=1 TO f:PRINT #9,t
ext$(g):NEXT g:CLOSEOUT:WINDOW SWAP 7,0:GOTO 2510
2560 CLEAR:WINDOW SWAP 0,7
2570 PRINT "Filename ?":le=15:l=1:c=12:GOSUB 2340:IF i$="" THEN 2570
2580 OPENIN i$:file=1:DIM text$(201):FOR f=1 TO 201:text$(f)=SPACE$(80):NEXT:f=1
2590 LINE INPUT #9,text$(f):IF EOF=-1 THEN 2610
2600 f=f+1:GOTO 2590
2610 CLOSEIN:WINDOW SWAP 7,0:GOTO 2510
2620 CLEAR:WINDOW SWAP 0,7:SAVE "AMSQUILL 1.0":WINDOW SWAP 7,0:GOTO 2510
2630 KEY DEF 16,1,16,16,16:KEY DEF 65,1,50,34,126:KEY DEF 66,1,252,252,252:KEY D
EF 70,1,253,253,254:KEY DEF 79,1,127,127,127:MODE 2:END
2640 IF file=0 THEN 2510
2650 FOR f=200 TO 1 STEP -1:IF text$(f)=SPACE$(80) THEN NEXT
2660 f=f+1:WINDOW SWAP 0,7:PRINT "Merging first file found on tape":OPENIN ""
2670 LINE INPUT #9,text$(f):IF EOF=-1 OR f=250 THEN 2700
2680 IF EOF=-1 OR f=200 THEN 2700
2690 f=f+1:GOTO 2670
2700 CLOSEIN:WINDOW SWAP 7,0:GOTO 2510
2710 WIDTH 255
2720 CLS #7:PRINT #7,"Starting line ?":le=3:l=24:c=17:GOSUB 2830:i=VAL(u$):IF i<
0 OR i>250 THEN 2720 ELSE s=i
2730 CLS #7:PRINT #7,"Ending line   ?":le=3:l=24:c=17:GOSUB 2830:i=VAL(u$):IF i<
s OR i>200 THEN 2730 ELSE e=i
2740 CLS #7:PRINT #7,"Page length   ?":le=2:l=24:c=17:GOSUB 2830:i=VAL(u$):IF i<
66 THEN 2740 ELSE p=i
2750 CLS #7:PRINT #7,"Copies        ?":le=2:l=24:c=17:GOSUB 2830:i=VAL(u$):IF i<
1 THEN 2750 ELSE o=i
2760 CLS #7:PRINT #7,"Please wait while printing text file.":PRINT #8,CHR$(27)CH
R$(64);CHR$(27)"C"CHR$(p);
2770 FOR j=1 TO o:FOR f=s TO e:FOR h=80 TO 1 STEP -1:IF MID$(text$(f),h,1)=CHR$(
32) THEN NEXT
2780 FOR g=1 TO h:a$=MID$(text$(f),g,1):IF a$>CHR$(127) THEN 2920
2790 PRINT #8,a$;:NEXT:PRINT #8,CHR$(13);:NEXT:NEXT:GOTO 2510
2800 CLS #7:PRINT #7,"Background colour ?":le=2:l=24:c=21:GOSUB 2830:i=VAL(u$):I
F i<0 OR i>26 THEN 2800
2810 a=-1:CLS #7:PRINT #7,"Foreground colour ?":le=2:l=24:c=21:GOSUB 2830:a=VAL(
u$):IF a<0 OR a>26 OR a=i THEN 2810
2820 BORDER i:INK 0,i:INK 1,a:GOTO 2510
2830 u$="":POKE 46311,0:FOR g=1 TO le+2:LOCATE c,l:PRINT "_"
2840 a$="":WHILE a$="":a$=INKEY$:WEND
2850 IF a$=CHR$(13) THEN 2910
2860 IF a$=CHR$(232) THEN 2890
2870 IF g=le+1 OR a$>CHR$(57) OR a$<CHR$(48) THEN 2840
2880 LOCATE c,l:PRINT a$;"_":c=c+1:u$=u$+a$:NEXT
2890 IF g=1 THEN 2840
2900 LOCATE c-1,l:PRINT "_ ":g=g-1:c=c-1:u$=LEFT$(u$,g-1):GOTO 2840
2910 LOCATE c,l:PRINT " ":RETURN
2920 IF a$=CHR$(170) THEN a$=" ":GOTO 2790
2930 IF a$=CHR$(135) THEN PRINT #8," "CHR$(27)"W"CHR$(1);:GOTO 2790
2940 IF a$=CHR$(136) THEN PRINT #8,CHR$(27)"W"CHR$(0);
2950 IF a$=CHR$(134) THEN PRINT #8," "CHR$(15);:GOTO 2790
2960 IF a$=CHR$(137) THEN PRINT #8,CHR$(18);
2970 IF a$=CHR$(133) THEN PRINT #8," "CHR$(27)"-"CHR$(1);:GOTO 2790
2980 IF a$=CHR$(138) THEN PRINT #8,CHR$(27)"-"CHR$(0);
2990 IF a$=CHR$(132) THEN PRINT #8,CHR$(27)"4";
3000 IF a$=CHR$(139) THEN PRINT #8,CHR$(27)"5";
3010 IF a$=CHR$(131) THEN PRINT #8,CHR$(27)"E";
3020 IF a$=CHR$(140) THEN PRINT #8,CHR$(27)"F";
3030 IF a$=CHR$(130) THEN PRINT #8,CHR$(27)"G";
3040 IF a$=CHR$(141) THEN PRINT #8,CHR$(27)"H";
3050 IF a$=CHR$(129) THEN PRINT #8," "CHR$(27)"M";:GOTO 2790
3060 IF a$=CHR$(142) THEN PRINT #8,CHR$(27)"P";
3070 IF a$=CHR$(128) THEN PRINT #8,CHR$(27)"p"CHR$(1);
3080 IF a$=CHR$(143) THEN PRINT #8,CHR$(27)"p"CHR$(0);
3090 IF a$=CHR$(144) THEN PRINT #8,CHR$(12);
3100 a$=" ":GOTO 2790
```

```
10 REM
20 REM      Amsquill Edit
30 REM
40 REM (C)1985 Justin Moffitt
50 REM
90 REM Reset the Caps Lock Key
100 KEY DEF 70,1,0,0,0
110 SPEED WRITE 1
120 REM Make Up Screen Display
130 MODE 1:INK 0,13:INK 1,26:BORDER 13:PAPER 0:PEN 1
140 LOCATE 14,2:PRINT CHR$(150)STRING$(12,CHR$(154))CHR$(156):LOCATE 14,3:PRINT
CHR$(149)"AMSQUILL 1.0"CHR$(149):LOCATE 14,4:PRINT CHR$(147)STRING$(12,CHR$(154)
)CHR$(153)
150 LOCATE 1,12:PRINT "1"STRING$(16,".")"Load ASCII program file":PRINT "2"STRIN
G$(13,".")"Load Amsquill program file"
160 LOCATE 1,24:PRINT SPACE$(11)"Press key (1 or 2)"SPACE$(11):CLEAR:a$="":WHILE
 a$<>"1" AND a$<>"2":a$=INKEY$:WEND
170 ON VAL(a$) GOTO 190,320
180 REM Load ASCII file
190 WINDOW 1,40,24,24:CLS:l=1:c=12:le=15:PRINT "Filename ?":GOSUB 430:IF i$="" T
HEN 190
200 f=1:OPENIN i$
210 DIM text$(200)
220 IF EOF=-1 OR f=200 THEN GOTO 290
230 LINE INPUT #9,a$
240 IF LEN(a$)=79 THEN text$(f)=a$+CHR$(170):f=f+1:GOTO 220
250 IF LEN(a$)>79 THEN 270
260 a$=a$+CHR$(170)+SPACE$(79-LEN(a$)):text$(f)=a$:f=f+1:GOTO 220
270 text$(f)=MID$(a$,1,80):a$=MID$(a$,81)
280 f=f+1:GOTO 240
290 CLOSEIN:OPENOUT i$:FOR g=1 TO f-1:PRINT #9,text$(g):NEXT:CLOSEOUT:WINDOW 1,4
0,1,25
300 GOTO 160
310 REM Load Amsquill file
320 WINDOW 1,40,24,24:CLS:DIM b$(200):DIM text$(200)
330 l=1:c=12:le=15:PRINT "Filename ?":GOSUB 430:IF i$="" THEN 330 ELSE a$=""
340 OPENIN i$
350 FOR f=1 TO 200:IF EOF=-1 THEN 370
360 LINE INPUT #9,text$(f):NEXT
370 CLOSEOUT:f=f+1
380 FOR g=1 TO f
390 FOR h=1 TO 80:IF MID$(text$(g),h,1)=CHR$(170) THEN 410 ELSE NEXT
400 a$=a$+text$(g):g=g+1:IF g=f+1 THEN 420 ELSE GOTO 390
410 a$=a$+MID$(text$(g),1,h-1):b$(g)=a$:a$="":NEXT
420 OPENOUT i$:FOR f=1 TO 200:PRINT #9,b$(f):NEXT:CLOSEOUT:WINDOW 1,40,1,25:GOTO
 130
```

PROGRAM FILE

```
430 REM Input filename
440 i$="":POKE 46311,0:POKE 46312,255:FOR g=1 TO le+2:LOCATE c,1:PRINT "_"
450 a$="":WHILE a$="":a$=INKEY$:WEND
460 IF a$=CHR$(13) THEN 540
470 IF a$=CHR$(127) THEN 520
480 IF g=le+1 THEN 450
490 IF a$>CHR$(126) THEN 450
500 IF a$<CHR$(32) THEN 450
510 LOCATE c,1:PRINT a$;"_":c=c+1:i$=i$+a$:NEXT g
520 IF g=1 THEN 450
530 LOCATE c-1,1:PRINT "_ ":g=g-1:c=c-1:i$=LEFT$(i$,g-1):GOTO 450
540 LOCATE c,1:PRINT " ":RETURN
```

Commodore 64 Trace/Walk/Step

by Alexander Sassoon

This program provides an invaluable set of utilities for Commodore 64 owners. Their use is described in REM statements within the program. The machine code data is input using letters to make it more compact and to reduce the strain of typing.

The checksum at the end of each line should ensure that you type in the data correctly.

```
1000 REM ******************************
1010 REM *                            *
1020 REM *     TRACE, STEP & WALK     *
1030 REM *                            *
1040 REM *   PROGRAM DEBUGGING AIDS   *
1050 REM *                            *
1060 REM *      FOR COMMODORE 64      *
1070 REM *                            *
1080 REM *   BY ALEXANDER SASSOON     *
1090 REM *                            *
1100 REM ******************************
1110 REM
1120 REM USE THE FOLLOWING COMMANDS
1130 REM BEFORE RUNNING YOUR BASIC
1140 REM PROGRAM.
1150 REM
1160 REM EACH COMMAND REMAINS EFFECTIVE
1170 REM EVERY TIME A PROGRAM IS RUN
1180 REM UNTIL REPLACED OR CANCELLED
1190 REM BY ENTERING A FURTHER COMMAND.
1200 REM
1210 REM -----------------------------
1220 REM            *TRACE
1230 REM -----------------------------
1240 REM STANDARD TRACE UTILITY WHICH
1250 REM PRINTS THE PROGRAM LINE NUMBER
1260 REM AS THE LINE IS EXECUTED.
1270 REM
1280 REM THE RUNNING OF THE PROGRAM MAY
1290 REM BE PAUSED BY HOLDING DOWN THE
1300 REM SHIFT OR COMMODORE LOGO KEY.
1310 REM
1320 REM -----------------------------
1330 REM            *STEP
1340 REM -----------------------------
1350 REM DISPLAYS THE CURRENT LINE
1360 REM NUMBER IN A WINDOW AT THE
1370 REM TOP RIGHT-HAND CORNER OF
1380 REM THE SCREEN.
1390 REM
1400 REM PRESS THE SHIFT KEY TO EXECUTE
1410 REM EACH LINE OF THE PROGRAM.
1420 REM HOLD DOWN THE SHIFT KEY TO JOG
1430 REM THROUGH THE PROGRAM AT A SLOW
1440 REM PACE.
1450 REM
1460 REM HOLD DOWN THE COMMODORE LOGO
1470 REM KEY TO SPRINT THROUGH YOUR
1480 REM PROGRAM AT ALMOST FULL SPEED.
1490 REM
1500 REM -----------------------------
1510 REM            *WALK
1520 REM -----------------------------
1530 REM ACTUALLY LISTS THE CURRENT
1540 REM PROGRAM LINE IN A WINDOW AT
1550 REM THE BOTTOM OF THE SCREEN.
1560 REM
1570 REM USE THE SHIFT AND COMMODORE
1580 REM LOGO KEYS TO EXECUTE EACH LINE
1590 REM IN THE SAME WAY AS FOR THE
1600 REM *STEP COMMAND.
1610 REM
1620 REM A PROGRAM LINE OF 80 OR MORE
1630 REM CHARACTERS WILL CAUSE THE
1640 REM SCREEN TO SCROLL DOWN A LINE.
1650 REM
1660 REM -----------------------------
1670 REM            *OFF
1680 REM -----------------------------
1690 REM SWITCHES OFF THE PROGRAMMING
1700 REM AIDS, ALLOWING YOUR PROGRAM TO
1710 REM RUN NORMALLY AT FULL SPEED.
1720 REM
1730 REM -----------------------------
1740 REM A LINE RANGE MAY BE SPECIFIED
1750 REM AFTER *TRACE, *STEP OR *WALK
1760 REM SO THAT THE UTILITY OPERATES
1770 REM ON ONLY PART OF THE PROGRAM.
1780 REM
1790 REM THE LINE RANGE USES EXACTLY
1800 REM THE SAME SYNTAX AS THE 'LIST'
1810 REM COMMAND.
1820 REM
1830 REM EXAMPLES:-
```

```
1840 REM
1850 REM  *TRACE 100-340
1860 REM      (THE TRACE UTILITY WILL
1870 REM      OPERATE ONLY WHILE LINES
1880 REM      100 TO 340 INCLUSIVE ARE
1890 REM      BEING EXECUTED.
1900 REM      ALL THE OTHER LINES WILL
1910 REM      BE EXECUTED NORMALLY)
1920 REM  *TRACE 3000-
1930 REM  *TRACE -20
1940 REM  *TRACE 10
1950 REM  *TRACE
1960 REM
1970 REM  ALL FOUR COMMANDS MAY ALSO
1980 REM  BE USED WITHIN YOUR PROGRAM.
1990 REM
2000 REM
2010 REM ******************************
2020 REM *  READ IN MACHINE CODE DATA  *
2030 REM ******************************
2040 REM  THE MACHINE CODE IS LOCATED
2050 REM  IN UNUSED MEMORY BETWEEN
2060 REM  ADDRESSES $C350 AND $C4F8.
2070 REM  THIS LEAVES THE FULL 38911
2080 REM  BYTES FREE FOR BASIC PROGRAMS.
2090 REM
2100 PRINT CHR$(147)
2110 PRINT " READING IN MACHINE CODE - PLEASE WAIT"
2120 PRINT
2130 FOR LINE=0 TO 42
2140 SUM=0
2150 FOR WRD=0 TO 4
2160 READ MCODE$
2170 N1 = (ASC(MCODE$)-65)*16 + ASC(MID$(MCODE$,2))-65
2180 N2 = (ASC(MID$(MCODE$,3))-65)*16 + ASC(MID$(MCODE$,4))-65
2190 IF N1>255 OR N2>255 OR N1<0 OR N2<0 THEN 2220
2200 POKE 50000 + LINE*10 + WRD*2, N1
2210 POKE 50001 + LINE*10 + WRD*2, N2
2220 SUM = SUM + (10-WRD*2)*N1 + (9-WRD*2)*N2
2230 NEXT WRD
2240 MOD = SUM - INT(SUM/97)*97
2250 READ CHECK$
2260 IF MOD <> VAL(CHECK$) THEN PRINT "PLEASE CHECK LINE" 2730+LINE*10 :ERR=1
2270 NEXT LINE
2280 IF ERR THEN END
2290 REM
2300 REM
2310 REM ******************************
2320 REM *    INITIALISE NEW COMMANDS   *
2330 REM ******************************
2340 SYS 50000
2350 PRINT "DEBUGGING AIDS INITIALISED"
2360 REM
2370 REM
2380 REM ******************************
2390 REM *  SAVE IN MACHINE CODE FORM  *
2400 REM ******************************
2410 REM  THE MACHINE CODE SAVED BY THIS
2420 REM  SECTION CAN BE LOADED WITHOUT
2430 REM  DESTROYING ANY BASIC PROGRAM
2440 REM  ALREADY IN MEMORY.
2450 REM
2460 REM  TO LOAD AND INITIALISE THE
2470 REM  UTILITIES ADD THE FOLLOWING
2480 REM  LINES TO YOUR PROGRAM:-
2490 REM
2500 REM      1 IF K THEN SYS 50000 :END
2510 REM      2 K=1 :LOAD
2520 REM
2530 REM  THESE LINES SHOULD BE REMOVED
2540 REM  AFTER THE MACHINE CODE HAS
2550 REM  BEEN LOADED.
2560 REM
2570 PRINT :INPUT "SAVE MACHINE CODE VERSION"; ANSWER$
2580 IF ANSWER$ <> "YES" AND ANSWER$ <> "Y" THEN END
2590 INPUT "DISK OR TAPE"; DEVICE$
2600 POKE 820,1
2610 IF LEFT$(DEVICE$,1) = "D" THEN POKE 820,8
2620 POKE 821,PEEK(45):POKE 822,PEEK(46)
2630 POKE 43,80  :POKE 44,195
2640 POKE 45,249 :POKE 46,196
2650 SAVE "TRACE/STEP/WALK", PEEK(820),3
2660 POKE 43,1 :POKE 44,8
2670 POKE 45,PEEK(821):POKE 46,PEEK(822)
2680 REM
2690 REM
2700 REM ******************************
2710 REM * COMPRESSED MACHINE CODE DATA*
2720 REM ******************************
2730 DATA KJGM,INAI,ADKJ,MDIN,AJAD,16
2740 DATA GAEP,EGEG,AAFE,FCEB,EDEF,84
2750 DATA AAKJ,AAFH,EBEM,ELAA,KFAC,40
2760 DATA NAHN,CAHD,AAAI,MJKM,PAAE,96
2770 DATA CIEM,OHKH,CIKC,AAIG,JOCA,81
2780 DATA HDAA,NNFL,MDPA,BAOI,LMFL,71
2790 DATA MDNA,PKOG,JOOI,OABA,JAOO,49
2800 DATA EMAI,KPCA,HDAA,OILN,FLMD,71
2810 DATA PAAG,CAPP,KODI,LAPE,KGJO,82
2820 DATA IGAC,PAML,CAHJ,AAJA,AGPA,69
2830 DATA AEMJ,KLNA,NNCA,GLKJ,KFBE,72
2840 DATA INAH,MEKF,BFIN,ADME,CAHJ,89
2850 DATA AAPA,AMMJ,KLNA,MHCA,HDAA,61
2860 DATA CAGL,KJNA,LPKF,BEIN,APME,1
2870 DATA KEBF,AFBF,NAAC,KAPK,IMAL,8
2880 DATA MECA,HJAA,EMOH,KHKF,DJKG,62
2890 DATA DKMJ,ABNA,AHOA,PPNA,ADEM,48
2900 DATA HAMD,INPC,MDIO,PGMD,OAAA,88
2910 DATA NAAC,MJAA,JAOP,OAPK,NAAC,69
2920 DATA MJAA,PAAC,LAOF,KEAC,IINA,12
2930 DATA BIKJ,FLCA,EHKL,CAMJ,LNKJ,34
2940 DATA FNCA,EHKL,CADP,KLKF,NDMJ,54
2950 DATA CBEM,ODME,PIKC,COLF,MGJN,20
2960 DATA AAAC,MKNA,PIII,NAEB,KCAH,20
2970 DATA KJKA,JNCA,AEKN,IGAC,JNCA,82
2980 DATA NIMK,NAPC,KACC,IEMH,CAAM,64
2990 DATA OFCA,MJLN,KCCO,LNAA,ACJF,54
3000 DATA MGMK,NAPI,KFMF,MJDP,PAJB,24
3010 DATA KNIN,ACMJ,ACPA,PHMJ,ABNA,63
3020 DATA OPKC,MAKA,PPII,NAPN,MKNA,53
3030 DATA PIPA,OHKA,HIKJ,CAJJ,GPAH,95
3040 DATA KNIG,ACJJ,GPNL,IINA,PCKA,30
3050 DATA CIKJ,EAJJ,GPAH,IINA,PKKC,21
3060 DATA BHCA,AMOF,KFDJ,IFBE,KFDK,10
3070 DATA IFBF,CABD,KGKA,ABIE,APKJ,35
```

PROGRAM FILE

```
3080 DATA MCIN,AAAD,KJME,INAB,ADIN,21
3090 DATA CHAD,KJNI,INCG,ADEM,NHKG,12
3100 DATA KJIL,INAA,ADKJ,ODIN,ABAD,60
3110 DATA KJMK,INCG,ADKJ,PBIN,CHAD,55
3120 DATA NAIA,MJAN,PAAD,EMMK,PBKJ,90
3130 DATA AAPA,PJJA,AHMJ,CHLA,ADCA,42
3140 DATA NHKK,KNIN,ACCJ,ADNA,PJEM,9
3150 DATA HAMD,AAAA,AAAA,AAAA,AAAA,62
3160 REM
3170 REM   IF THE PROGRAM REPORTS ERRORS
3180 REM   IN ALL THE DATA LINES THEN
3190 REM   CHECK LINES 2130 TO 2260.
3200 END
```

Oric Assembler

by Eric Polmear

This assembler works on both the Oric 1 and Atmos computers. It is written in Basic and so is slow. It allows you to enter and edit your assembler program as if it were in Basic, Orics do not perform any syntax checks as lines are entered in Basic. The assembler takes up lines 40000 onwards and will read, assemble and POKE into memory a source file in line numbers 0 to 29999. Type in the listing and save it before trying it out.

The assembler recognises the standard 6502 instruction set and in addition, these false mnemonics are provided: REM, END, DAB, DAD, DA#, DA$ and LBL. Their use is described in the instructions below. The assembler is sensitive to the format of individual lines, but following the examples should cause no problems. Although the example given is for the Oric 1 only, the same format should be used for the Atmos. The commands available are as follows.

REM — use as in Basic. All lines starting with REM will be ignored by the assembler. Do not use it after accumulator addressing. An example is given in line 10 of the sample program.

END — this marks the end of the source program for assembly and is useful for testing.

DATA — data can be specified in four ways. DAB 500 simply opens up a work-space of 500 bytes and fills each byte with 0 during assembly. DAD allows decimal data to be specified, DA# allows hex data and DA$ allows string data which should be entered in quotes. Examples of these can be found in the source code listing.

LABELS — label numbers 0 and 10 are pre-defined and can be used without further definition. They are 0 (zero page) and the run address of the assembled code respectively. Other labels must be defined before use. Labels one-nine are reserved for zero-page use only and labels 11 onward are for other labels only. Points in the source program can be defined as labels by placing them in the correct place as in line 270. Absolute labels can be defined anywhere in the source code for ROM calls, and so on, as in lines 10 through 170. Label numbers are always read as decimal, the addresses as hex, even if the # is omitted.

IMPLIED ADDRESSING — an example of this is in line 320 of the sample source file.

RELATIVE ADDRESSING — branch instructions should be followed by a label as in line 240. An absolute displacement or address will not work. If no label is specified, it is assumed to branch back to label 10 at the start of the code.

ACCUMULATOR ADDRESSING — as in the accumulator shift instructions ASR, and so on. The mnemonic should not be followed by any address.

IMMEDIATE ADDRESSING — immediate values must be preceded by one of #, HL or LL. Line 440 compares the accumulator with the immediate hex value 24. Line 600 loads the accumulator with the low byte of the address labelled by label 48. Line 610 loads the Y register with the high byte of label 48.

ZERO PAGE — zero page addresses stand alone and are read as hex or one of the first 10 labels, as in line 200.

ZERO PAGE,X — as in line 490, or with a label as in STA L7,X.

ZERO PAGE,Y — as for ZERO PAGE,X.

(ZERO PAGE,X) — for example, LDA (70,X) or LDA (L7,X).

(ZERO PAGE),Y — for example, STA (L7), Y or LDA (70),Y.

ABSOLUTE — as in line 390, or JSR AA0E.

ABSOLUTE,X — LDX 123F,X or STX L20,X.

ABSOLUTE,Y — as for ABSOLUTE,X.

(ABSOLUTE) or INDIRECT — for example JMP(34DE) or JMP(L34).

```
1 ASSEMBLE
Check the lines which will be listed then type RUN 50000. The
assembly variables to be checked are as follows:

50010 HIMEM should be set to protect the assembled code from the
BASIC program. Not necessary for short routines at #400.

50020 ST is the start address for assembly. #8000 gives a good
balance between memory required for the basic and the assembled
code.
```

50030 RU is the address at which the code will run. This will usually be the same as ST, but does not have to be. Eg, if you want the code to run at #2000 (not directly accessible because it will over-write the basic) set RU accordingly. When assembled the code will not run at ST, but must be copied down to RU after NEWing the assembler. So for a 500 byte program, the direct command   FOR N=0 TO 499:POKE 8192+N,PEEK(32768+N):NEXT will do the trick.

50040 NL is the number of labels wanted; 100 is usually enough.
L0 is always zero page 0 and should not be re-defined.
L1 to L9 are for other zero page labels only.
L10 is always RU (the start) and should not be re-defined.
L11 onwards are for other non zero page labels only.

RUN 50000 will assemble source lines up to 29999 or END if one has been inserted. Assembly is rather slow so make a cuppa tea! The disassembler source here takes just over 20 minutes. If any changes are made to the source, then it must be re-assembled.

2 DISASSEMBLE
This will call the disassembler at #8000. Disarm by replacing line 41200 with GOTO 40000 until it is fully working.

3 LLIST SOURCE
This lists the lines up to 29999 to a printer. For those without a printer, the option can be disarmed by changing the 41300 in line 40150 to 40000.

4 RENUMBER SOURCE
This will renumber all lines below 30000, starting at 10 and with an increment of 10. It is useful for opening up space when editing, or just for tidying up. If you have added a basic program using 30000-39999, it will not be affected. This option works at about 20 lines/second so is not too slow.

5 CSAVE SOURCE
On the ATMOS, this option CSAVEs only the lines numbered up to 29999. On the ORIC-1 (without the Join command) the whole lot is CSAVEd. Highly recommended before trying to run the assembled code. Q for 'any key' will return to the menu.

6 CSAVE CODE
This CSAVEs the assembled code - also recommended before running it. The start and end addresses will be given at the end of assembly, and should be noted before proceeding.

7 LIST LABELS
This lists the labels in hex to the screen. Press any key to advance the listing.

8 LLIST LABELS
This dumps all the labels to a printer. Disarm if necessary by changing the 41800 in line 40170 to 40000.

9 EXIT
This performs a warm reset and control is lost from the menu. RUN 40000 will restart, but the variables will be lost.

RUN CODE
This option has purposefully been left out, to avoid potential crashes. After CSAVEing all that you value, use 9 (exit) and CALL, or even DOKE #2F5 with the run address and use !

```
30000 REM   LINES 30000-39999 ARE AVAILABLE FOR
30010 REM   YOUR OWN BASIC PROGRAMS AND WILL
30020 REM   NOT BE RE-NUMBERED BY MENU OPTION 4
31000 REM *************************************************
31010 REM *****     EPSON PRINTER ROUTINE FOLLOWS       *****
31020 REM *************************************************
32000 IF PEEK(#D000)=#A6 THEN CALL#E6CA ELSE CALL #E76A
32010 E$=CHR$(27):PRINT"PRESS RESET AFTER LISTING"
32020 LPRINT E$;"@";E$;"1";CHR$(4);E$;"E";E$;"3";CHR$(31);:LLIST30000-
39000 REM *********************************************
39010 REM *****     ASSEMBLER PROGRAM FOLLOWS       *****
39020 REM *********************************************
40000 REM ASSEMBLER...ORIC-1/ATMOS
40010 E$=CHR$(27):POKE #31,90:CLS:PRINT:PRINT:PING
40020 IF PEEK(#D000)=#A6 THEN CALL#E804 ELSE CALL #E93D
40030 PRINT:PRINT"        OPTIONS:":PRINT
40040 PRINT:PRINT"        ASSEMBLE..........1"
40050 PRINT:PRINT"        DISASSEMBLE.......2"
40060 PRINT:PRINT"        LLIST SOURCE......3"
40070 PRINT:PRINT"        RENUMBER SOURCE...4"
40080 PRINT:PRINT"        CSAVE SOURCE......5"
40090 PRINT:PRINT"        CSAVE CODE........6"
40100 PRINT:PRINT"        LIST LABELS.......7"
40110 PRINT:PRINT"        LPRINT LABELS.....8"
40120 PRINT:PRINT"        EXIT..............9":PRINT
40140 GET A$:IF ASC(A$)<49 OR ASC(A$)>57 THEN 40140
40150 V=VAL(A$):ON V GOTO 41100,41200,41300,41400,41500
40170 V=V-5:ON V GOTO 41600,41700,41800,41900
41100 CLS:PRINT:PRINT:PRINT
41110 PRINT"CHECK THESE LINES THEN TYPE"
41120 PRINT"RUN 50000":PRINT:PRINT:LIST 50000-50099
41200 IF DEEK(#8850)=#3F3F THEN CALL#8000 ELSE 40000
41300 IF PEEK(#D000)=#A6 THEN CALL#E6CA ELSE CALL #E76A
41310 PRINT:PRINT"PRESS RESET AFTER LISTING"
41320 PRINT"THEN RUN 40000":LLIST-29999
41400 PRINT"RE-NUMBERING....":C0=#501:Z0=10:Z1=10
41410 IF PEEK(#D000)=#A6 THEN CALL#E6CA ELSE CALL #E76A
41420 IF DEEK(C0+2)>29999 THEN 40000
41430 DOKE C0+2,Z0:Z0=Z0+Z1:C0=DEEK(C0):IF Z0<30000 THEN 41420
41440 PRINT"LOWER Z1 IN LINE 41400 & REDO":GOTO 61000
41500 IF PEEK(#D000)=#A6 AND DEEK(#4F2)=#6556 THEN 41508
41502 IF PEEK(#D000)=#A9 THEN 41508 ELSE 41600
41508 N=#501:PRINT"PLEASE WAIT .."
41510 IF DEEK(N+2)<30000 THEN N=DEEK(N):GOTO 41510
```

PROGRAM FILE

```
41520 DOKE #BFE0,DEEK(#9C):DOKE #BFE2,DEEK(N):DOKE #BFE4,N
41530 DOKE N,0:DOKE #9C,N+2
41540 PRINT"   START TAPE THEN PRESS ANY KEY":GET A$
41550 IF A$="Q" THEN 41560 ELSE CSAVE "SOURCE"
41560 DOKE#9C,DEEK(#BFE0):DOKE DEEK(#BFE4),DEEK(#BFE2):GOTO40000
41600 PRINT"   START TAPE THEN PRESS ANY KEY"
41610 GET A$:IF A$="Q" THEN 40000
41620 IF V=5 THEN CSAVE NS$:GOTO 40000
41630 CSAVE NC$,AST,EEN:GOTO 40000
41700 FOR N=0 TO NL:PRINT N,HEX$(LL(N)):GET A$:NEXT:GOTO 40000
41800 IF PEEK(#D000)=#A6 THEN CALL#E6CA ELSE CALL #E76A
41810 I=INT(NL/6)-1:FOR P=0 TO I:FOR M=0 TO 5:N=6*P+M
41820 S=3-1*(N<100)-1*(N<10):LPRINT SPC(S);N;HEX$(LL(N));
41830 NEXT M:LPRINT:NEXT P
41840 FOR P=N+1 TO NL:LPRINT SPC(S);P;HEX$(LL(P));
41850 NEXT P:LPRINT:GOTO 40000
41900 IF PEEK(#D000)=#A6 THEN CALL#F882 ELSE CALL#F8B2
50000 REM ASSEMBLE
50010 HIMEM #7FF0   :REM BELOW ST
50020 ST=#8000      :REM ASSEMBLY ADR
50030 RU=#8000      :REM RUN ADR
50040 NL=100        :REM NO OF LABELS
50050 NS$="SOURCE"  :REM SOURCE NAME
50060 NC$="DIS"     :REM CODE NAME
50070 REM
50080 REM      ALSO CHECK SOURCE ONLY
50090 REM      NAME IN LINE 41550
50100 IF PEEK(#D000)=#A6 THEN CALL#E6CA ELSE CALL #E76A
50110 IF DEEK(#503)>29999 THEN 40000
50120 PRINT"INITIALISING ...":GOSUB 60000
50130 PRINT"FIRST PASS ...":LL(10)=RU:ADR=RU:CO=#501:GOSUB 51000
50140 PRINT"ASSEMBLING ...":ADR=ST:CO=#501:GOSUB 52000
50150 EN=AD-1:IF PEEK(#D000)=#A6 THEN CALL#E807 ELSE CALL #E940
50160 PRINT:PRINT:IF ST<>RU THEN PRINT"RUN ADDRESS = ";HEX$(RU)
50170 PRINT"START = ";HEX$(ST),"END = ";HEX$(EN)
50180 PRINT:PRINT"PRESS ANY KEY FOR MENU":GET A$:GOTO 40000
51000 REM FIRST PASS
51010 PO=PEEK(CO+4):DO=DEEK(CO+4):IF PO=#9D OR PO=#80 THEN
      B=0:GOTO 51400
51020 IF DO=#424C THEN C1=6:GOSUB 59000:GOSUB 59200:GOTO 51400
51030 IF DO=#4144 THEN GOSUB 56500:GOTO 51400
51100 REM AA
51110 IF DO=#D252 THEN C1=5:GOTO 51180
51120 N=-1:REPEAT:N=N+1:UNTIL N=36 OR DEEK(CO+5)=AA%(N,0)
51130 C1=6:IF N=36 THEN 51200
51140 IF PO<>AA%(N,2) THEN 51200
51150 IF N<25 THEN B=1:GOTO 51400
51160 IF N<33 THEN B=2:GOTO 51400
51180 REPEAT:C1=C1+1:UNTIL PEEK(CO+C1)<>32
51190 IF PEEK(CO+C1)=0 THEN B=1:GOTO 51400
51200 REM BB
51210 N=-1:IF PO=#D1 THEN C1=5:GOTO 51300
51230 IF DO=#D245 OR DO=#41D2 OR DO=#D252 THEN C1=6:GOTO 51300
51240 REPEAT:N=N+1:UNTIL N=19 OR DEEK(CO+5)=BB%(N,0)
51250 C1=7:IF N=19 THEN LI=51250:M=0:GOTO 61000
51260 IF PO<>BB%(N,11) THEN 51240
51270 IF PO=74 THEN B=3:GOTO 51400
51300 IF PEEK(CO+C1)=32 THEN C1=C1+1:GOTO 51300
51310 P=PEEK(CO+C1):D=DEEK(CO+C1)
51320 IF P=35 OR D=#4C4C OR D=#4C48 THEN B=2:GOTO 51400
51330 IF P=40 THEN C1=C1+1:P=PEEK(CO+C1)
51340 IF P<>76 THEN F=16:GOSUB 53000:H=10+(H<256):GOTO 51370
51350 C1=C1+1:F=10:GOSUB 53000
51370 IF H<10 THEN B=2 ELSE B=3
51400 AD=AD+B:CO=DEEK(CO):IF PO=#80 THEN RETURN
51410 IF DEEK(CO+2)<30000 THEN 51000 ELSE RETURN
52000 REM PASS 2
52010 PO=PEEK(CO+4):DO=DEEK(CO+4)
52015 N=-1:PRINT DEEK(CO+2)
52020 IF PO=#9D OR PO=#80 OR DO=#424C THEN 52900
52030 IF DO=#4144 THEN GOSUB 56000:GOTO 52900
52040 REPEAT:N=N+1:UNTIL N=36 OR DEEK(CO+5)=AA%(N,0)
52045 IF N=36 THEN 52080
52050 IF PO<>AA%(N,2) THEN 52200
52060 IF N<25 THEN POKE AD,AA%(N,1):AD=AD+1:GOTO 52900
52070 IF N<33 THEN GOSUB 57000:GOTO 52900
52080 IF N=36 AND DO<>#D252 THEN 52200
52090 IF N=36 THEN C1=5 ELSE C1=6
52100 REPEAT:C1=C1+1:UNTIL PEEK(CO+C1)<>32
52110 IF PEEK(CO+C1)=0 THEN POKE AD,AA%(N,1):AD=AD+1:GOTO 52900
52200 N=-1:REM BB
52210 REPEAT:N=N+1:UNTIL N=19 OR DEEK(CO+5)=BB%(N,0)
52220 IF N<19 AND PO<>BB%(N,11)THEN 52210
52230 IF N<19 THEN N1=N:C1=7:GOTO 52300
52240 C1=6:IF PO=#D1 THEN N1=19:C1=5:GOTO 52300
52260 IF DO=#D245 THEN N1=20:GOTO 52300
52270 IF DO=#41D2 THEN N1=21:GOTO 52300
52280 IF DO=#D252 THEN N1=22:GOTO 52300
52290 LI=52290:M=0:GOTO 61000
52300 IF PEEK(CO+C1)=32 THEN C1=C1+1:GOTO 52300
52310 P=PEEK(CO+C1):D=DEEK(CO+C1)
52320 IF P<>35 THEN 52350
52330 C1=C1+1:F=16:GOSUB 53000:N2=1:GOTO 52800
52350 IF D=#4C4C OR D=#4C48 THEN 52360 ELSE 52400
52360 C1=C1+2:F=10:GOSUB 53000:GOSUB 59300:N2=1:H=LL(H)
52370 J=INT(H/256):IF D=#4C48 THEN H=J:GOTO 52800
52380 H=H-256*J:GOTO 52800
52400 IF P<>40 THEN 52500
52410 C1=C1+1:P=PEEK(CO+C1)
52420 IF P<>76 THEN F=16:GOSUB 53000:GOTO 52440
52430 C1=C1+1:F=10:GOSUB 53000:GOSUB 59300:H=LL(H)
52440 IF P=44 AND DEEK(CO+C1+1)=#2958 THEN N2=5:GOTO 52800
52450 IF P=41 AND DEEK(CO+C1+1)=#592C THEN N2=6:GOTO 52800
52460 N2=10:GOTO 52850
52500 IF P<>76 THEN F=16:GOSUB 53000:GOTO 52520
52510 C1=C1+1:F=10:GOSUB 53000:GOSUB 59300:H=LL(H)
52520 IF N1=8 OR N1=9 THEN N2=7:GOTO 52850
52530 IF H>255 THEN 52700
52600 IF P=0 OR P=32 THEN N2=2:GOTO 52800
52610 IF P=44 AND PEEK(CO+C1+1)=88 THEN N2=3:GOTO 52800
52620 IF P=44 AND PEEK(CO+C1+1)=89 THEN N2=4:GOTO 52800
52630 LI=52630:M=0:GOTO 61000
52700 IF P=0 OR P=32 THEN N2=7:GOTO 52850
52710 IF P=44 AND PEEK(CO+C1+1)=88 THEN N2=8:GOTO 52850
52720 IF P=44 AND PEEK(CO+C1+1)=89 THEN N2=9:GOTO 52850
52730 LI=52730:M=0:GOTO 61000
52800 IF BB%(N1,N2)=#FF OR H>#FF THEN M=5:LI=52800:GOTO 61000
52810 POKE AD,BB%(N1,N2):POKE AD+1,H:AD=AD+2:GOTO 52900
52850 IF BB%(N1,N2)=#FF THEN M=5:LI=52850:GOTO 61000
52860 POKE AD,BB%(N1,N2):DOKE AD+1,H:AD=AD+3
```

```
52900 CO=DEEK(CO):IF PO=#80 THEN RETURN
52910 IF DEEK(CO+2)<30000 THEN 52000 ELSE RETURN
53000 REM READ NO
53010 H=0:IF PEEK(CO+C1)=32 THEN C1=C1+1:GOTO 53010
53020 P=PEEK(CO+C1):IF P>47 AND P<58 THEN P=P-48:GOTO 53050
53030 IF P>64 AND P<71 AND F=16 THEN P=P-55:GOTO 53050
53040 RETURN
53050 H=H*F+P:C1=C1+1:GOTO 53020
56000 REM DATA SUB
56010 B=0:C1=6:P=PEEK(CO+C1):IF P<>66 THEN 56100
56030 C1=C1+1:F=10:GOSUB 53000:IF H=0 THEN RETURN
56040 FOR N=1 TO H:POKE AD,0:AD=AD+1:NEXT:B=H:RETURN
56100 IF P<>36 THEN 56200
56110 REPEAT:C1=C1+1:P=PEEK(CO+C1):UNTIL P=0 OR P=34
56120 IF P=0 THEN RETURN
56130 C1=C1+1:P=PEEK(CO+C1):D=DEEK(CO+C1)
56140 IF D=34 THEN RETURN
56150 POKE AD,P:AD=AD+1:GOTO 56130
56200 IF P=35 THEN F=16:GOTO 56300
56210 IF P=68 THEN F=10:GOTO 56300
56220 LI=56220:M=0:GOTO 61000
56300 C1=C1+1:GOSUB 53000:IF H>255 THEN 56350
56320 POKE AD,H:AD=AD+1:IF P=44 THEN 56300
56340 IF P=0 THEN RETURN
56350 LI=56350:M=4:GOTO 61000
56500 REM DTA SUB 2
56510 B=0:C1=6:P=PEEK(CO+C1):IF P<>36 THEN 56600
56530 REPEAT:C1=C1+1:P=PEEK(CO+C1):UNTIL P=0 OR P=34
56540 IF P=0 THEN RETURN
56550 REPEAT:C1=C1+1:B=B+1:D=DEEK(CO+C1):UNTIL D<256
56560 IF D=34 THEN B=B-1:RETURN
56570 LI=56570:M=4:GOTO 61000
56600 IF P<>66 THEN 56700
56610 C1=C1+1:F=10:GOSUB 53000:B=H:RETURN
56700 IF P=35 OR P=68 THEN 56710 ELSE 56730
56710 REPEAT:C1=C1+1:P=PEEK(CO+C1):UNTIL P=0 OR P=44
56720 B=B+1:IF P=44 THEN 56710 ELSE RETURN
56730 LI=56730:M=0:GOTO 61000
57000 REM REL ADR
57010 POKE AD,AA%(N,1):AD=AD+2:C1=6:H=0
57030 REPEAT:C1=C1+1:P=PEEK(CO+C1):UNTIL P=0 OR P=76
57040 IF P=0 THEN H=10:GOTO 57060
57050 C1=C1+1:F=10:GOSUB 53000:GOSUB 59300
57060 X=LL(H)-AD+ST-RU
57080 IF X<-128 OR X>127 THEN LI=57080:M=1:GOTO 61000
57090 X=X-256*(X<0):POKE AD-1,X:RETURN


59000 REM LBL SUB 1
59010 C1=C1+1:F=10:GOSUB 53000:IF H<=NL THEN RETURN
59030 LI=59030:M=1:GOTO 61000
59200 REM LBL SUB 2
59210 B=0:NO=H:IF H=0 OR LL(NO)<>0 THEN LI=59210:M=2:GOTO 61000
59220 IF P<>212 THEN LL(NO)=AD:GOSUB 59400:RETURN
59230 C1=C1+1:IF PEEK(CO+C1)=35 THEN C1=C1+1
59240 F=16:GOSUB 53000:LL(NO)=H:H=NO:GOSUB 59400:RETURN
59300 REM LBL CHECK
59310 IF H>0 AND LL(H)=0 THEN LI=59310:M=3:GOTO 61000
59400 IF H<10 AND LL(H)>255 THEN LI=59400:M=6:GOTO 61000
59410 IF H>10 AND LL(H)<256 THEN LI=59410:M=3:GOTO 61000
59420 IF LL(H)>#FFFF THEN LI=59420:M=1:GOTO 61000
59430 RETURN
60000 REM SET UP ARRAYS
60010 DIM AA%(36,2):DIM BB%(22,11):DIM LL(NL):CS=0
60020 FOR N=0 TO 36:FOR N1=0 TO 2:READ D$
60030 V=VAL("#"+D$):AA%(N,N1)=V:CS=CS+V:NEXT:NEXT
60060 FOR N=0 TO 22:FOR N1=0 TO 11:READ D$
60070 V=VAL("#"+D$):BB%(N,N1)=V:CS=CS+V:NEXT:NEXT
60080 IF CS<>1287936 THEN PRINT"DATA ERROR IN SUB 60000":GOTO 61000
60100 DATA 4B52,00,42,434C,18,43,444C,D8,43,494C,58,43,564C,B8,43
60105 DATA 5845,CA,44,5945,88,44,584E,E8,49,594E,C8,49,504F,EA,4E
60110 DATA 4148,48,50,5048,08,50,414C,68,50,504C,28,50,4954,40,52
60115 DATA 5354,60,52,4345,38,53,4445,F8,53,4945,78,53,5841,AA,54
60120 DATA 5941,A8,54,5853,BA,54,4158,8A,54,5358,9A,54,4159,98,54
60125 DATA 4343,90,42,5343,B0,42,5145,F0,42,494D,30,42,454E,D0,42
60130 DATA 4C50,10,42,4356,50,42,5356,70,42
60135 DATA 4C53,0A,41,5253,4A,4C,4C4F,2A,52,20D2,6A,D2
60150 DATA 4344,69,65,75,FF,61,71,6D,7D,79,FF,41
60160 DATA 4C53,FF,06,16,FF,FF,FF,0E,1E,FF,FF,41
60170 DATA 5449,FF,24,FF,FF,FF,FF,2C,FF,FF,FF,42
60180 DATA 504D,C9,C5,D5,FF,C1,D1,CD,DD,D9,FF,43
60190 DATA 5850,E0,E4,FF,FF,FF,FF,EC,FF,FF,FF,43
60200 DATA 5950,C0,C4,FF,FF,FF,FF,CC,FF,FF,FF,43
60210 DATA 4345,FF,C6,D6,FF,FF,FF,CE,DE,FF,FF,44
60220 DATA 434E,FF,E6,F6,FF,FF,FF,EE,FE,FF,FF,49
60230 DATA 504D,FF,FF,FF,FF,FF,FF,4C,FF,FF,6C,4A
60240 DATA 5253,FF,FF,FF,FF,FF,FF,20,FF,FF,FF,4A
60250 DATA 4144,A9,A5,B5,FF,A1,B1,AD,BD,B9,FF,4C
60260 DATA 5844,A2,A6,FF,B6,FF,FF,AE,FF,BE,FF,4C
60270 DATA 5944,A0,A4,B4,FF,FF,FF,AC,BC,FF,FF,4C
60280 DATA 5253,FF,46,56,FF,FF,FF,4E,5E,FF,FF,4C
60290 DATA 4C4F,FF,26,36,FF,FF,FF,2E,3E,FF,FF,52
60300 DATA 4342,E9,E5,F5,FF,E1,F1,ED,FD,F9,FF,53
60310 DATA 4154,FF,85,95,FF,81,91,8D,9D,99,FF,53
60320 DATA 5854,FF,86,FF,96,FF,FF,8E,FF,FF,FF,53
60330 DATA 5954,FF,84,94,FF,FF,FF,8C,FF,FF,FF,53
60340 DATA 7FFF,29,25,35,FF,21,31,2D,3D,39,FF,FF
60350 DATA 7FFF,49,45,55,FF,41,51,4D,5D,59,FF,FF
60360 DATA 7FFF,09,05,15,FF,01,11,0D,1D,19,FF,FF
60370 DATA 7FFF,FF,66,76,FF,FF,FF,6E,7E,FF,FF,FF
60400 FOR N=0 TO 6:READ M$(N):NEXT:FR=FRE(""):RETURN
60500 DATA"UNKNOWN INSTRUCTION IN LINE"
60510 DATA"LABEL OUT OF RANGE IN LINE"
60520 DATA"LABEL USED TWICE IN LINE"
60530 DATA"UNKNOWN LABEL IN LINE"
60540 DATA"FORMAT ERROR IN LINE"
60550 DATA"ILLEGAL ADDRESSING MODE IN LINE"
60560 DATA"LABEL NOT ZERO PAGE IN LINE"
61000 IF PEEK(#D000)=#A6 THEN CALL#E804 ELSE CALL #E93D
61010 PRINT LI:PRINT M$(M);DEEK(CO+2):SHOOT:END


10 REM ORIC-1   JOIN/VERIFY/LOAD
20 LBL 11=E725  CHECK PARAMETERS
30 LBL 12=E6CA  SET 6522
40 LBL 13=E804  RESET 6522
50 LBL 14=E563  CLEAR STATUS
60 LBL 15=E503  SEARCHING
70 LBL 16=E576  PRINT TO STATUS
80 LBL 17=E696  SYNC CASSETTE
90 LBL 18=E630  READ BYTE FROM TAPE
```

PROGRAM FILE

```
100 LBL 19=E6F0    COMPARE NAMES
110 LBL 20=F82F    PRINT FILENAME
120 LBL 21=E554    INC COUNTER
130 LBL 22=E4EB    LOAD FILE
140 LBL 23=FA85    PING
150 LBL 24=FA9B    SHOOT
160 LBL 25=E53E    ABORT
170 LBL 26=C56F    LINE LINK POINTERS
180 PHA
190 LDA #0
200 STA 0
210 STA 1
220 PLA
230 CMP #56
240 BNE L50
250 STA 0
260 BPL L51
270 LBL 50
280 CMP #4A
290 BNE L52
300 STA 1
310 LBL 51
320 JSR E2
330 LBL 52
340 JSR L11
350 JSR L12
360 JSR L14
370 LDA LL15
380 LDY HL15
390 JSR L16
400 LBL 34
410 JSR L17
420 LBL 30
430 JSR L18
440 CMP #24
450 BNE L30
460 LDX #9
470 LBL 31
480 JSR L18
490 STA 5D,X
500 DEX
510 BNE L31
520 LBL 32
530 JSR L18
540 BEQ L33
550 STA 49,X
560 INX
570 BNE L32
580 LBL 33
590 STA 49,X
600 LDA LL48
610 LDY HL48
620 JSR L75
630 JSR L19
640 TXA
650 BNE L34
660 LDA 0
670 BEQ L60
680 LDA LL49
690 LDY HL49
700 JSR L75
710 LDA 5F
720 STA 33
730 LDA 60
740 STA 34
750 LDY #0
760 LBL 35
770 JSR L18
780 BCS L40
790 CMP (33),Y
800 BNE L40
810 JSR L21
820 BCC L35
830 JSR L13
840 JSR L23
850 RTS
860 LBL 40
870 JSR L24
880 PLA
890 PLA
900 JMP L25
910 LBL 60
920 LDA 1
930 BEQ L70
940 LDA 64
950 BNE L70
960 LDA 9C
970 LDY 9D
980 SEC
990 SBC #2
1000 BCS L61
1010 DEY
1020 LBL 61
1030 STA 5F
1040 STY 60
1050 SEC
1060 SBC 9A
1070 TAX
1080 TYA
1090 SBC 9B
1100 TAY
1110 CLC
1120 TXA
1130 ADC 61
1140 STA 61
1150 TYA
1160 ADC 62
1170 STA 62
1180 LBL 70
1190 LDA #12
1200 LDY #E5
1210 JSR L75
1220 JSR L22
1230 JSR L13
1240 LDA 64
1250 BNE L71
1260 LDA 61
1270 STA 9C
1280 LDA 62
1290 STA 9D
1300 LDA 1
1310 BEQ L71
1320 JSR L26
1330 LBL 71
1340 RTS
1350 LBL 75
1360 PHA
1370 JSR L14
1380 PLA
1390 JSR L16
1400 INX
1410 INX
1420 INX
1430 LDA #49
1440 LDY #00
1450 JMP L20
1460 LBL 48
1470 DA# 10,7
1480 DA$ "Found  .."
1490 DA# 0
1500 LBL 49
1510 DA# 10,7
1520 DA$ "Verifying  .."
1530 DA# 0
```

Memotech Renumber

by J Waller

This program renumbers Basic line numbers, GOTOs, GOSUBs and RESTOREs. When run, the new starting line number and the increment required must be entered. The complete assembler program is then moved into high memory to make way for the program to be renumbered. This version is written for the MTX512, so the following changes are necessary to make it suitable for the MTX500:

Change the assembler code start address to 800F and all subsequent addresses should begin with 8, not 4.

Assembler line 400F (800F on the 500) must be LD HL,#801B.

Basic line 70 — 16411 becomes 32795, 16437 becomes 32821.

Basic line 90 — 16411 becomes 32795, 16412 becomes 32796.

Basic line 110 — 16415 becomes 32799, 16416 becomes 32800.

The renumbered program can be saved as usual.

```
10 GOSUB 70
20 CODE

400F          LD HL,#401B        ; From
4012          LD DE,#F000        ; To
4015          LD BC,877  ; No of Bytes
4018          LDIR
401A          RET
401B          DS 2       ; Starting LNO
401D          DS 2       ; Next LNO
401F          DS 2       ; Increment
4021          DS 5       ; New number st
ore
4026          DS 1       ; Digits in new
 LNO
4027          DS 1       ; Digits in old
 LNO
4028          DS 2       ; Tab. ptr
402A          DS 2       ; Tab. base
402C          DS 2       ; Line start
402E          DS 2       ; Byte store
4030          DS 2       ; LNO
4032          DS 2       ; Work area
4034          DS 2       ; Tab. top
4036          LD HL,(#F000)         ; Get s
tarting LNO
4039          LD (#F002),HL         ; Make
it next LNO
403C          LD HL,0
403F          LD (#F017),HL
4042          LD HL,(#FAA7)
4045          LD BC,100
4048          ADD HL,BC
4049          LD (#F00D),HL      ; Store
```

```
 tab ptr
404C          LD (#F00F),HL       ; Save
table base
404F          LD HL,(#FAAA)       ; Get l
ine start
4052          LD BC,(#FAA7)       ; BASTO
P
4056 LOOP:    LD (#F011),HL       ; Save
line start
4059          LD E,(HL)  ; Get bytes
405A          INC HL
405B          LD D,(HL)
405C          LD (#F013),DE       ; Save
bytes
4060          INC HL    ; Get
4061          LD E,(HL) ; old
4062          INC HL    ; line
4063          LD D,(HL) ; no.
4064          LD (#F015),DE       ; Save
line no.
4068 LOOP1:   OR A
4069          LD A,(HL)
406A          INC HL
406B          CP 150     ;GOTO
406D          JR Z,STORE
406F          CP 151     ; GOSUB
4071          JR Z,STORE
4073          CP 178     ; RESTORE
4075          JR Z,STORE
4077          CP 255     ; LINE END
4079          JR Z,LEND
407B          CP 194     ; ASSEM
407D          JR Z,ASSEM ; Ignore assemb
ler
407F          JR LOOP1
4081 ASSEM:   LD DE,(#F013)       ; Bytes
4085          LD HL,(#F011)       ; Get l
ine start
4088          ADD HL,DE
4089 LEND:    LD A,B
408A          CP H
408B          JR NZ,LOOP
408D          LD A,C
408E          CP L
408F          JR NZ,LOOP
4091          LD HL,(#F00D)       ; Tab.
ptr
4094          LD (#F019),HL       ; Save
tab. top
4097          JR STAGE2
4099 STORE:   OR A
409A          LD A,(HL)
409B          CP 44         ; COMMA
409D          JR Z,COMMA
409F          CP 58         ; COLON
40A1          JR Z,COLON
40A3          CP 195        ; ELSE
40A5          JR Z,COLON
40A7          CP 255        ; EOL
40A9          JR Z,EOL
40AB          OR A
40AC          LD A,(HL)
40AD          INC HL
40AE          SBC A,48
40B0          PUSH HL
40B1          PUSH BC
40B2          LD HL,(#F017)
40B5          ADD HL,HL
40B6          LD B,H
40B7          LD C,L
40B8          ADD HL,HL
40B9          ADD HL,HL
40BA          ADD HL,BC
40BB          LD D,0
40BD          LD E,A
40BE          ADD HL,DE
40BF          LD (#F017),HL       ; Runni
ng total
40C2 BACK:    POP BC
40C3          POP HL
40C4          JR STORE
40C6 COMMA:   INC HL
40C7          PUSH HL
40C8          PUSH BC
40C9          CALL #F0C8 ; **** PUT
40CC          JR BACK
40CE COLON:   INC HL
40CF          PUSH HL
40D0          PUSH BC
40D1          CALL #F0C8 ; *** PUT
40D4          POP BC
40D5          POP HL
40D6          JR LOOP1
40D8 EOL:     PUSH HL
40D9          PUSH BC
40DA          CALL #F0C8 ; **** PUT
40DD          POP BC
40DE          POP HL
40DF          INC HL
40E0          JR LEND
40E2          RET
40E3 PUT:     LD BC,(#F015)       ; Get o
ld line no.
40E7          LD IY,(#F00D)       ; Get t
ab ptr
40EB          LD (IY+0),C         ; Old L
NO
40EE          LD (IY+1),B         ;  into
 table
40F1          LD (IY+2),0         ; Clear
 marker byte
40F5          LD BC,(#F017)
40F9          LD (IY+3),C         ; GOTO
LNO
40FC          LD (IY+4),B         ;  into
 table
40FF          LD (IY+5),0         ; Clear
 marker byte
4103          LD DE,6
4106          ADD IY,DE  ; Inc tab. ptr
4108          LD (#F00D),IY       ; Save
tab. ptr
410C          LD HL,0
410F          LD (#F017),HL
4112          RET
4113 STAGE2:  LD HL,(#FAAA)       ; Main
Pointer
4116          LD (#F011),HL       ; Line
```

PROGRAM FILE

```
start
4119 LINE:     LD BC,(#F00F)      ; Bot o
f tab
411D           LD (#F00D),BC      ; Tab p
tr
4121           LD IX,(#F011)      ; Get m
ain ptr
4125           LD E,(IX+2)        ; Line
No
4128           LD D,(IX+3)        ; in DE
412B           LD (#F015),DE      ; Save
LNO
412F           LD DE,(#F002)      ; Get n
ew LNO
4133           LD (IX+2),E        ; New L
NO
4136           LD (IX+3),D        ; into
Line
4139           LD C,(IX+0)        ; Get B
ytes
413C           LD B,(IX+1)
413F           ADD IX,BC
4141           LD (#F011),IX      ; Save
otr
4145 SEARCH:   LD BC,(#F00F)      ; Get t
ab base
4149           LD DE,(#F019)      ; Get t
ab top
414D           LD A,B     ; Anything in
414E           CP D       ;  table?
414F           JR NZ,TAB  ; Yes
4151           LD A,C
4152           CP E
4153           JR NZ,TAB     ; Yes
4155           JR NOTAB   ; No
4157 TAB:      LD IY,(#F00D)      ; Get t
ab ptr
415B           LD C,(IY+0)        ; Get N
o
415E           LD B,(IY+1)        ; from
table
4161           LD A,B
4162           CP 0
4164           JR NZ,NONZ
4166           LD A,C
4167           CP 0
4169           JR NZ,NONZ
416B           JR TESTET    ; Number is 0
416D NONZ:     LD DE,(#F015)      ; Get L
NO
4171           LD A,B     ; Compare
4172           CP D       ; LNO
4173           JR NZ,TESTET       ; with
4175           LD A,C     ; Table
4176           CP E
4177           JR NZ,TESTET
4179           LD A,(IY+2)        ; Get m
arker byte
417C           CP 1       ; Set?
417E           JR Z,TESTET        ; Alrea
dy changed
4180           LD HL,(#F002)      ; Get n
ew LNO
4183           LD (IY+0),L        ; New L
ine No
4186           LD (IY+1),H        ;  into
 Table
4189           LD (IY+2),1        ; Set m
arker byte
418D TESTET:   LD DE,3
4190           ADD IY,DE   ; Advance tab p
tr
4192           LD (#F00D),IY      ; Save
tab ptr
4196           LD BC,(#F00D)
419A           LD DE,(#F019)      ; Top o
f table
419E           LD A,D     ; Test for
419F           CP B       ; end of
41A0           JR NZ,TAB  ; table
41A2           LD A,E
41A3           CP C
41A4           JR NZ,TAB
41A6 NOTAB:    LD DE,(#F002)      ; Get n
ew LNO
41AA           LD HL,(#F004)      ; Get i
ncrement
41AD           ADD HL,DE  ; New LNO
41AE           LD (#F002),HL      ; Save
new LNO
41B1           LD HL,(#F011)      ; Get p
ointer
41B4           LD BC,(#FAA7)
41B8           LD A,H     ; Check
41B9           CP B       ; end
41BA           JP NZ,#F0FE        ; of **
** LINE
41BD           LD A,L     ; prog
41BE           CP C
41BF           JP NZ,#F0FE        ; *****
 LINE
41C2           JR STAGE3
41C4 DIV:      LD A,B     ; Dividend in A
C
41C5 DIV2:     LD HL,0    ; Divisor in DE
41C8           LD B,16
41CA LOOP16:   RL C
41CC           RLA
41CD           ADC HL,HL
41CF           SBC HL,DE
41D1           JR NC,SKIP
41D3           ADD HL,DE
41D4 SKIP:     CCF
41D5           DJNZ LOOP16
41D7           RL C
41D9           RLA
41DA           LD B,A     ; Result in BC
41DB           RET        ; Remainder in
HL
41DC CALC:     PUSH IX
41DE           EXX
41DF           LD IX,#F006        ; Ten t
hou
41E3           LD DE,10000        ; First
 divisor
41E6           LD A,1     ; Count
41E8           PUSH AF    ; Save it
41E9           LD C,(IY+3)        ; Divid
```

```
end (new LNO)
41EC          LD B,(IY+4)          ;  in B
C
41EF REPDIV:  CALL #F1A9 ; DIV ***
41F2          POP AF     ; Get count
41F3          LD (IX+0),C          ; Save
result
41F6          INC IX
41F8          INC A      ; Inc count
41F9          CP 5       ; Done?
41FB          JR Z,LAST  ; Yes
41FD          PUSH AF    ; Save count
41FE          PUSH HL    ; Save remainde
r
41FF          PUSH DE    ; Change diviso
r
4200          POP BC     ;  to dividend
4201          LD DE,10   ; Divide diviso
r
4204          CALL #F1A9 ;  by 10   DIV
***
4207          LD B,A
4208          PUSH BC
4209          POP DE     ; New divisor
420A          POP BC     ; New dividend
420B          JR REPDIV
420D LAST:    LD (IX+0),L          ; Chang
e
4210          LD E,48    ;  binary
4212          LD B,5     ;  to
4214          LD C,0     ;  ASCII
4216          LD IX,#F006          ;  and
421A COUNT:   LD A,(IX+0)          ;  coun
t
421D          CP 0       ;  digits
421F          JR NZ,CHAR2
4221          LD A,B
4222          CP 1
4224          JR Z,CHAR
4226          INC IX
4228          DEC B
4229          JR COUNT
422B CHAR:    LD A,(IX+0)
422E CHAR2:   ADD A,E
422F          LD (IX+0),A
4232          INC IX
4234          INC C
4235          DJNZ CHAR
4237          LD A,C
4238          LD (#F00B),A         ; Chars
 in new LNO
423B          EXX
423C          POP IX
423E          RET
423F STAGE3:  LD BC,(#F00F)        ; Get t
ab base
4243          LD (#F00D),BC        ; Save
it
4247          LD DE,(#F019)        ; Get t
ab top
424B          LD A,B     ; Anything in
424C          CP D       ; table?
424D          JR NZ,YES
424F          LD A,C
4250          CP E
4251          JR NZ,YES
4253          RET
4254 YES:     LD IX,(#FAAA)        ; Main
ptr
4258 BACK2:   LD BC,(#F00D)        ; Tab p
tr
425C          LD DE,(#F019)        ; Table
 top
4260          LD A,D     ; Test for
4261          CP B       ; end of tab
4262          JR NZ,AGAIN
4264          LD A,E
4265          CP C
4266          JR NZ,AGAIN
4268          RET
4269 AGAIN:   LD IY,(#F00D)        ; Get t
ab ptr
426D          LD C,(IY+0)          ; Get l
ine no
4270          LD B,(IY+1)          ; from
table
4273          LD E,(IX+2)          ; Get
4276          LD D,(IX+3)          ; LNO
4279          LD A,D
427A          CP B
427B          JR NZ,NOMATCH
427D          LD A,E
427E          CP C
427F          JR NZ,NOMATCH
4281          JR MATCH
4283 NOMATCH: LD E,(IX+0)
4286          LD D,(IX+1)
4289          ADD IX,DE
428B          JR BACK2
428D MATCH:   PUSH IX    ; Line start
428F          POP HL     ;  into HL
4290          LD DE,4
4293          ADD HL,DE  ; Start of text
4294 LOOP2:   OR A
4295          LD A,(HL)
4296          INC HL
4297          CP 150     ; GOTO
4299          JR Z,FOUND
429B          CP 151     ; GOSUB
429D          JR Z,FOUND
429F          CP 178     ; RESTORE
42A1          JR Z,FOUND
42A3          CP 255     ; EOL
42A5          JR Z,BACK2
42A7          JR LOOP2
42A9 FOUND:   CALL #F1C1 ;  CALC ***
42AC          LD B,0
42AE REP:     OR A
42AF          LD A,(HL)
42B0          CP 44      ; COMMA
42B2          JR Z,COMMA2
42B4          CP 58      ; COLON2
42B6          JR Z,COLON2
42B8          CP 195     ; ELSE
42BA          JR Z,COLON2
42BC          CP 255
42BE          JR Z,EOL2
42C0          INC HL
```

PROGRAM FILE

```
42C1            INC B        ; Count chars
42C2            LD A,B
42C3            LD (#F00C),A
42C6            JR REP
42C8 COMMA2:    CALL #F2BD  ; WORK ****
42CB            INC HL
42CC            JR FOUND
42CE COLON2:    CALL #F2BD  ; WORK ****
42D1            JR LOOP2
42D3 EOL2:      CALL #F2BD  ; WORK ****
42D6            JR BACK2
42D8 WORK:      LD DE,6
42DB            ADD IY,DE
42DD            LD (#F00D),IY         ; Save
tab. ptr
42E1            PUSH HL
42E2            LD A,(#F00C)          ; Figur
es in old LNO
42E5            LD HL,#F00B           ; Figur
es in new LNO
42E8            SBC A,(HL)
42E9            POP HL
42EA            JR Z,SAME    ; Same number o
f figures
42EC            JR C,MORE    ; More figures
 in new LNO
42EE            JR LESS      ; Fewer figures
 in new LNO
42F0 SAME:      CALL #F356  ; INSERT ***
42F3            RET
42F4 MORE:      LD (#F011),HL         ; Save
main ptr
42F7            NEG
42F9            LD HL,(#FAA7)         ; BASTO
P
42FC            LD B,0
42FE            LD C,A       ; Diff in BC
42FF            ADD HL,BC
4300            PUSH HL      ; BASTOP+Diff
4301            LD L,(IX+0)
4304            LD H,(IX+1)           ; Byte
count in HL
4307            ADD HL,BC
4308            LD (IX+0),L           ; New
430B            LD (IX+1),H           ;  byte
 count
430E            LD HL,(#FAA7)         ; BASTO
P
4311            LD BC,(#F011)         ; Main
ptr
4315            OR A
4316            SBC HL,BC
4318            LD D,0
431A            LD E,1
431C            ADD HL,DE
431D            PUSH HL
431E            POP BC       ; Bytes to move
431F            LD HL,(#FAA7)         ; Old B
ASTOP
4322            POP DE       ; New BASTOP
4323            LD (#FAA7),DE         ; Store
 it
4327            LDDR
4329            LD HL,(#F011)         ; Resto
re ptr
432C            CALL #F356  ; INSERT ***
432F            RET
4330 LESS:      LD (#F011),HL         ; Save
ptr
4333            PUSH HL
4334            LD B,0
4336            LD C,A       ; Diff
4337            OR A
4338            SBC HL,BC
433A            PUSH HL
433B            LD HL,(#FAA7)         ; BASTO
P
433E            OR A
433F            SBC HL,BC
4341            PUSH HL      ; New BASTOP
4342            LD L,(IX+0)           ; Byte
count
4345            LD H,(IX+1)           ;  in H
L
4348            OR A
4349            SBC HL,BC
434B            LD (IX+0),L           ; New
434E            LD (IX+1),H           ;  byte
 count
4351            LD HL,(#FAA7)         ; BASTO
P
4354            LD BC,(#F011)         ; Old p
tr
4358            OR A
4359            SBC HL,BC
435B            LD D,0
435D            LD E,1
435F            ADD HL,DE
4360            PUSH HL
4361            POP BC       ; Bytes to move
4362            POP HL
4363            LD (#FAA7),HL         ; New B
ASTOP
4366            LD HL,(#F011)         ; Old p
tr
4369            POP DE       ; New ptr
436A            LDIR
436C            POP HL       ; Restore ptr
436D            CALL #F356  ; INSERT ***
4370            RET
4371 INSERT:    LD A,(#F00C)          ; Figur
es in old LNO
4374            LD B,A
4375 ALIGN:     DEC HL
4376            DJNZ ALIGN
4378            LD B,5
437A            LD DE,#F006
437D WRITE:     LD A,(DE)
437E            INC DE
437F            CP 0
4381            JR Z,SKIP2
4383            LD (HL),A
4384            INC HL
4385 SKIP2:     DJNZ WRITE
4387            RET
```

```
Symbols:
LEND     4089   STORE   4099
COMMA    40C6   COLON   40CE
EOL      40D8   BACK    40C2
LOOP     4056   PUT     40E3
LOOP1    4068   STAGE2  4113
SEARCH   4145   TESTET  418D
ASSEM    4081   NONZ    416D
TAB      4157   NOTAB   41A6
STAGE3   423F   YES     4254
BACK2    4258   AGAIN   4269
NOMATCH  4283   MATCH   428D
DIV      41C4   DIV2    41C5
LOOP16   41CA   SKIP    41D4
CALC     41DC   REPDIV  41EF
LAST     420D   COUNT   421A
CHAR2    422E   CHAR    422B
LOOP2    4294   FOUND   42A9
REP      42AE   COMMA2  42C8
COLON2   42CE   EOL2    42D3
SAME     42F0   MORE    42F4
LESS     4330   INSERT  4371
WRITE    437D   SKIP2   4385
ALIGN    4375   WORK    42D8
LINE     4119

30 CLS
40 PRINT "Now load Program to be renumb
ered and  press `PLAY'": PRINT
50 PRINT : PRINT "Then key `RAND USR(61
467)'"
60 PRINT : LOAD "": STOP
70 CLS : FOR I=16411 TO 16437: POKE I,0
: NEXT
80 INPUT "Starting Number ";START
90 POKE 16411,MOD(START,256): POKE 1641
2,INT(START/256)
100 PRINT : INPUT "Increment by ";INC
110 POKE 16415,MOD(INC,256): POKE 16416
,INT(INC/256)
120 RETURN
```

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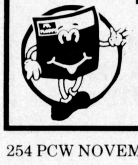

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Sony	SMC-70	Aug82
Sord	Exleigh Expert	Aug82
Texas Instruments	Professional	May83
Torch Computers	Torch	Jan83
Victor	Sirius 1	Feb82
Xerox	820	Jan82
Hand-held		
Canon	H-07	March84
Casio	602p	May82
Casio	Fx-820p	March85
Casio	PB-100	May83
Hewlett-Packard	15C & 16C	Sept82
Hewlett-Packard	HP-75C	Nov82
Microwriter	Microwriter	Sept82
Sharp	PC-1350	March85
Sharp	PC1251	Feb83
Sharp	PC1500	June82
Texas Instruments	TI-59	Jan83
Texax Instruments	TI-88	July82
Home		
Acorn	BBC Micro	Jan82
Acorn	Electron	Oct83
Amstrad	464	May84
Amstrad	Amstrad 6128	Sept85
Atari	400/800	Oct80
Camputers	Lynx	March83
Coleco	Adam	April82
Commodore	64	May83
Commodore	128	July85
Commodore	Plus/4	Oct84
Commodore	Vic20	Sept81
Dragon Data	Dragon 32	Aug82
Eaca International	Colour Genie	June83
Enterprise	Enterprise	Nov84
IBM	PC Junior	March84
Jupiter Cantab	Ace	Jan83
Mattel	Aquarius	Nov83
Memotech	Memotech RS 128	Oct84
Multitech	Micro-Professor II	Sept83
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Sharp	MZ-700	Feb84
Sharp	MZ-80A	June82
Sinclair	QL	June84
Sinclair	ZX81	June81
Sinclair	ZH Spectrum	June82
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Sord	M5	Aug83
Spectravideo	SV-318 & SV-328	March84
Tandy	MC10	Nov83
Tatung	Einstein	Aug84
Texas Instruments	TI99/4A	March82
Tradecom	Newbrain RD	July82
Lap-held		
Data General	Data General One	Dec84
Epson	PX-8	June84
Epson	HX-20	Dec82
Gavilan	Gavilan MC	Feb84
Grid	Compass	June84
Hewlett-Packard	HP-110	July84
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Sord	IS-11C	Oct 85
Talbot Computers	Dialtex-4	Feb85
Tandy	Model 100	Aug83
Texas Instruments	ProLite	May85
Thorn EMI	Liberator	Sept85
Luggable		
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Apple	IIc	Aug84
Ericsson	Portable	Sept85
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Jonos	Jonos	April84
Morrow	Pivot Two	Sept85
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Osborne	Executive	July83
Quadram	Datavue	Sept85
Semi-Tech	Pied Piper	Sept83
Visuall	Commuter	May85
Wren Computer	Wren	April84
Zenith	Zenith 171	Sept85
Multi-user		
Ashton Technology	Crystal	July84
Compaq	Deskpro 286	Aug85
Fortune	Fortune 32:16	Aug83
IBM	PC AT	Dec84
Kaypro	286i	Aug85
North Star Computers	Dimension	March85
TDI	Pinnacle	Jan85

SOFTWARE

PROGRAM	SUPPLIER	ISSUE
Accountancy		
Accountancy Round-up	Various	June83
Financial Director	Financial Director	June83
Home Accounts	Diamondsoft	Jan84
Microtax	Tax Planning	July83
Sage 400	Sage	Oct83
Communications		
Datatalk	Datasoft	Jan85
Perfect Link	Perfect Software	July84
Vicom	AM Technology	Sept85
Database		
1983 Database Round-up	Various	Dec83
1984 Database Round-up	Various	Jan84
Aquila	Kent Barlow Assocs	Sept82
Aspect	Microft Technology	Oct84
Beta	Ormskirk Computers	Aug83
Busifile	European Information	Jan84
Busipost	Busipost	Feb83
Cardbox	Caxton Software	Aug82
Complete Manager	Pipeline software	March85
Condor Database	Condor Corp	Nov82
Dataflex	Equinox	Aug85
Dataplan	Personal Software	Aug83
Dataprism	Bonsai	March83
Dbase II	Ashton Tate	May82
Dbase III	Ashton Tate	Nov84
DBMS 2	GW Computers	June82
Delta	Compsoft	Oct83
Everyman	Vector International	Feb84
File (Macintosh)	Microsoft	July85
Files & Folders	ACT Pulsar	Dec84
Filevision	Telos Software	Dec84
Friday!	Ashton Tate	July84
Information Management	BPI	April84
Infostar	MicroPro	Sept83
Knowledgeman	Data Base Experts	Feb85
Omnis	Blyth Computers	July83
Optimum	Uveon	Nov83
Pearl	Pearl Software	Oct82
Perfect II	Thorn EMI	May85
Personal Database	Supersoft	March84
Power Base	Accent Computers	April85
Rescue	MBS	April83
Retrieve II	Derwent Datasysems	Jan85
RMS	Dragon Data	June84
Search & Find	Hitan Systems	Dec83
Secect	Bonsai	Sept82
Sensible Solution	O'Hanlon Systems	Sept84
Silicon Office	Bristol Software	July82
Superfile	Southdata	Jan83
Sycero	System C	July85
TIM IV	Paradigm	Sept85
Tomorrow's Office	Stage One Software	June83
Acornsoft	Viewstore	Oct 85
Desk organiser		
QED +	Quantec	March85
Sidekick	Borland	March85
Spotlight	Software Arts	March85
Entertainment		
Hitch-Hiker's Guide	Infocom	Jan85

Music Master	Supersoft	Jan 85
Music Typewriter	Romantic Robot	Jan 85
Musicalc	Paradox Group	Jan 85
Expert system		
ES/P Advisor	Expert Systems	Sept 84
Expert Ease	Expert Software	June 84
Texas Instruments	Personal Consultant	Oct 85
Integrated system		
Appleworks	Apple	July 84
Framework	Ashton Tate	Aug 84
Jane	Arktronics	July 84
Jazz	Microsoft	Aug 85
Open Access	SPI	June 84
Smart	Innovative Software	Sept 84
Symphony	Lotus	Aug 84
Hchange	Psion	Oct 84
Language		
Basic (Macintosh)	Apple	Feb 85
Basic 2 (Macintosh)	Microsoft	May 85
BCPL (BBC)	Acornsoft	June 85
BCPL (QL)	Metacomco	June 85
C (Spectrum)	HiSoft	Nov 84
Lisp (QL)	Metacomco	Feb 85
Logo (BBC)	Acornsoft	Feb 85
Logo (BBC)	Logotron	Feb 85
Logo (BBC)	Open University	Feb 85
Logo (Spectrum)	Sinclair	Oct 84
Modula 2 (PC)	Volition Systems	Feb 85
Pascal (Amstrad)	Amsoft	Feb 85
Pascal (QL)	Computer One	Feb 85
Pascal, ISO (BBC)	Acornsoft	Feb 85
Pascal, ISO (QL)	Metacomco	July 85
Pascal, Turbo (PC)	Borland	April 85
Miscellaneous		
Brainstorm	Caxton Software	Feb 84
Codewriter	Codewriter	April 85
Entrepreneur	Tryptych	March 85
Aldus Systems	PageMaker	Oct 85
TK! Solver	Software Arts	Feb 84
Operating environment		
Desq	Quarterdeck	Dec 83
GEM	Digital Research	Feb 85
Top View	IBM	Aug 85
Visi-On	Visicorp	Nov 83
Visuall	Trillian	Jan 84
Windows	Microsoft	Aug 85
Operating system		
CP/M-86	Digital Research	Oct 82
MS-DOS	Microsoft	Oct 82
MS-DOS version 2	Microsoft	May 83
Revelation	Cosmos Inc	April 84
Spreadsheet		
1-2-3	Lotus	Nov 83
1983 Spreadsheet Round-up	Various	Dec 83
1984 Spreadsheet Round-up	Various	Dec 84
Dynacalc	Dragon Data	June 84
Ecalc	Epson	July 83
Fcalc	Sord	Jan 84
Financial Planner	Ashton Tate	Dec 83
Masterplanner	Comshare	April 84
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Prophet II	Busicomputers	March 83
The Spreadsheet	Microl	Sept 83
Viewsheet	Acorn	Jan 85
Visicalc	Visicorp	June 83
Vu-Calc	Psion	Sept 83
Utility		
E40	Keel Codes	Sept 82
PC Automator	Direct Technology	July 85
Word processor		
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HP41C Text Editor	Hesselberg	Nov 82
Micropen	Intelligence Ireland	May 83
Microscript	Intelligence Ireland	May 85
Paperback Writer	Paperback Software	Aug 85
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QX Text	QX Software	July 84
Samna +	Thorn EMI	July 85
Scred	Stable Software	Aug 83
Scripsit 2	Tandy	Feb 82
Spellbinder	Lexisoft	Aug 81
Bristol Software Factory	Telewriter	Oct 85
View	Acornsoft	Aug 83
Word (IBM PC)	Microsoft	June 84
Word (Macintosh)	Microsoft	June 85
Word Handler II	Sillicon Valley	March 83
Wordspell	Griffin Software	March 84
Wordstar 2000	MicroPro	Feb 85
Workwriter	Data Applications	Nov 84

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Buzzbox modem	DaCom	Jan 84
Compunet	Compunet	Dec 84
Demon modem	Demon Products	July 85
Homelink	NBS	March 84
Knowledge Index	Dialog	Sept 85
Modems	Various	Oct 85
Portman modem	Interlekt	Oct 84
Teletext adapter	Vector Marketing	April 84
WSS2000 modem	Minor Miracles	May 84
Expansion		
Graduate	Torch	June 85
McMill 68008 card	Stellation Two	July 85
Graphics		
Bit Stick	Robocom	Nov 82
Koala Pad	Audiogenic	Jan 85
Penpad	Kode	Oct 84
Mass storage		
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Discovery 1	Opus Supplies	May 85
Hobbit	Ikon	Jan 84
Microdrive	Sinclair	Oct 83
TCCR530	Tandberg	July 84
Miscellaneous		
Music 500	Acorn	May 85
Omni-Reader	Oberon	May 85
RGB televisions	Various	March 85
Telesketch	Gamma	June 85
Printer/plotter		
Alphacom 81	Alphacom	Sept 84
Apple	LaserWriter	Oct 85
EP44	Brother	April 84
Epson	FX-80	July 83
HR-5	Brother	Sept 84
Juki 6100	Micro Peripherals	Dec 84
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Penman	Penman	Feb 85
TC6000	Brother	April 85
Speech		
Acorn speech system	Acorn	Jan 84
Adman synthesiser	Adman	Jan 84
Amstrad SSA-1	Amstrad	Sept 85
BBC Speech Chips	Acorn	April 83
Chatterbox	WSS	Jan 84
Microspeech	Currah	Jan 84
TI Speech	Texas Instruments	Nov 84
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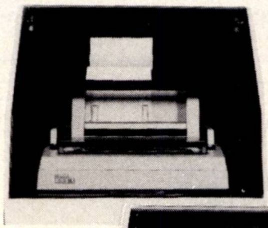

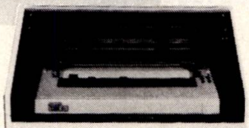

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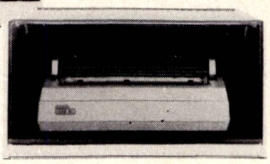

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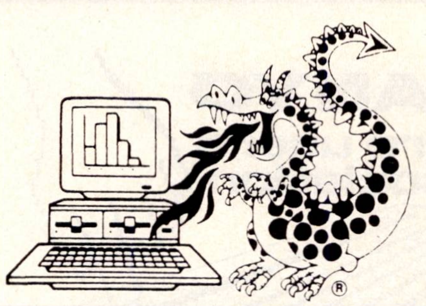

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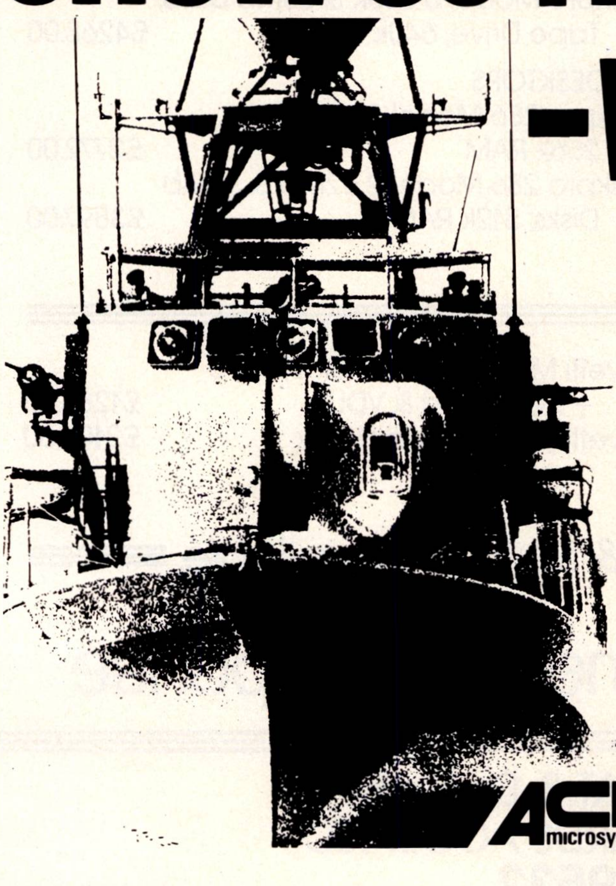

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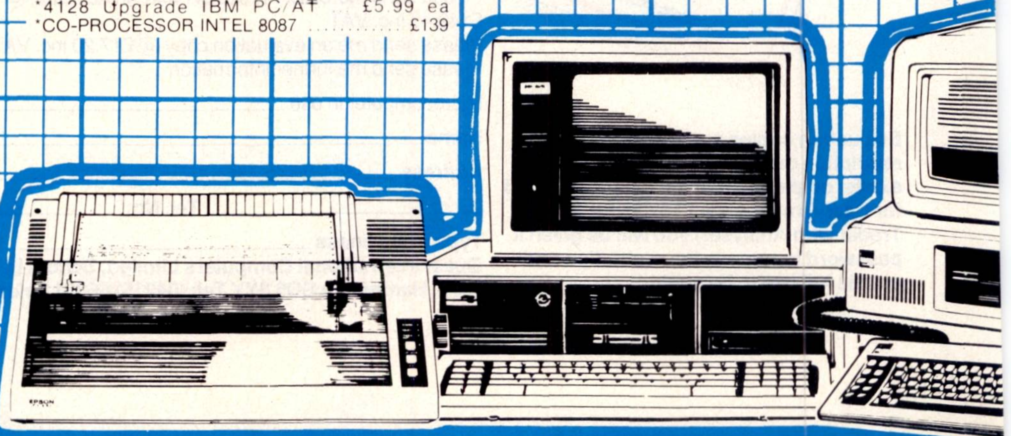

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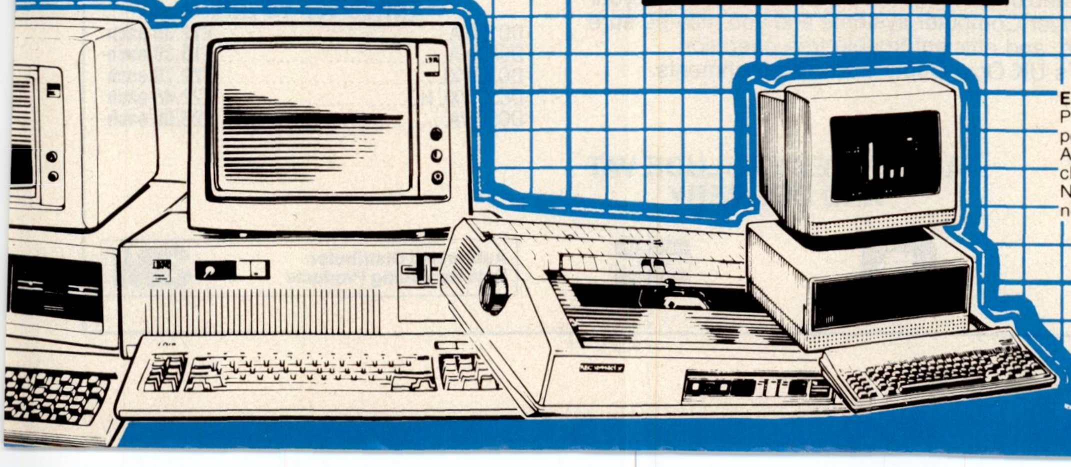

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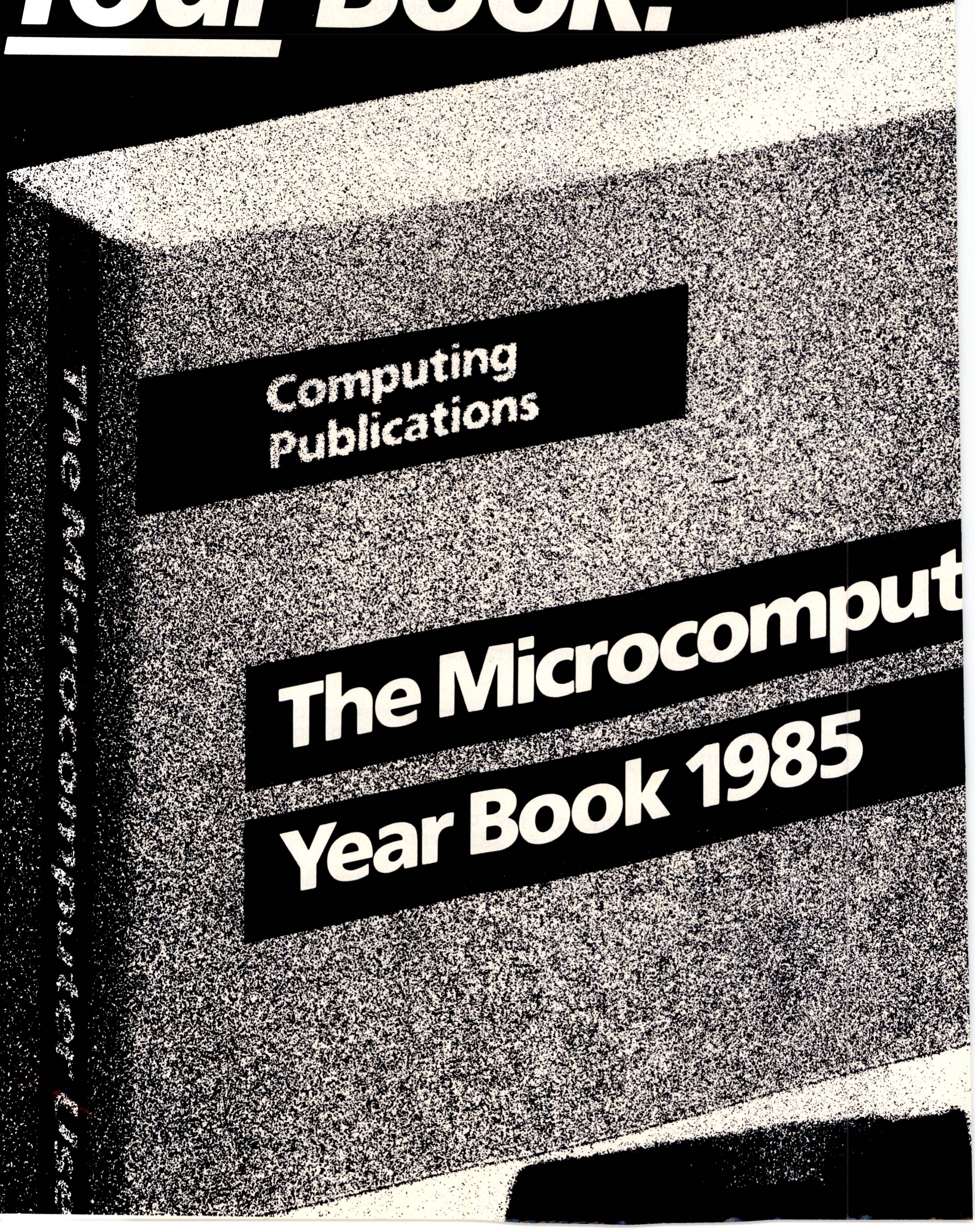
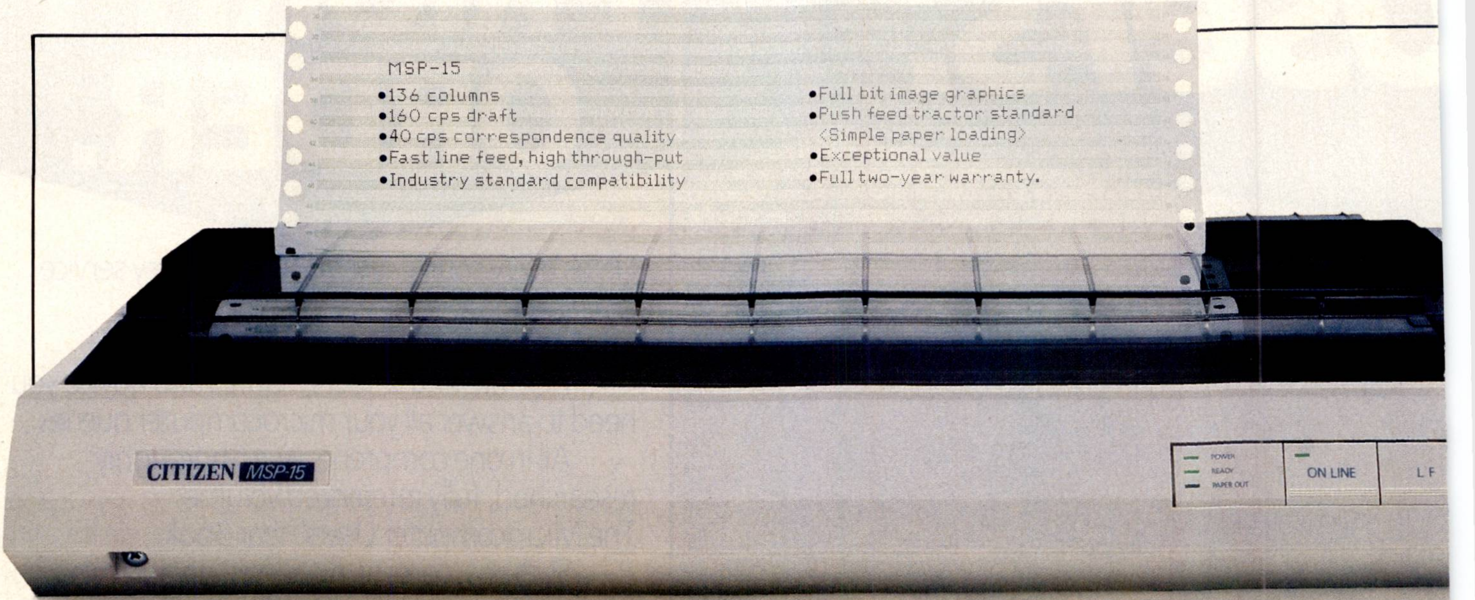
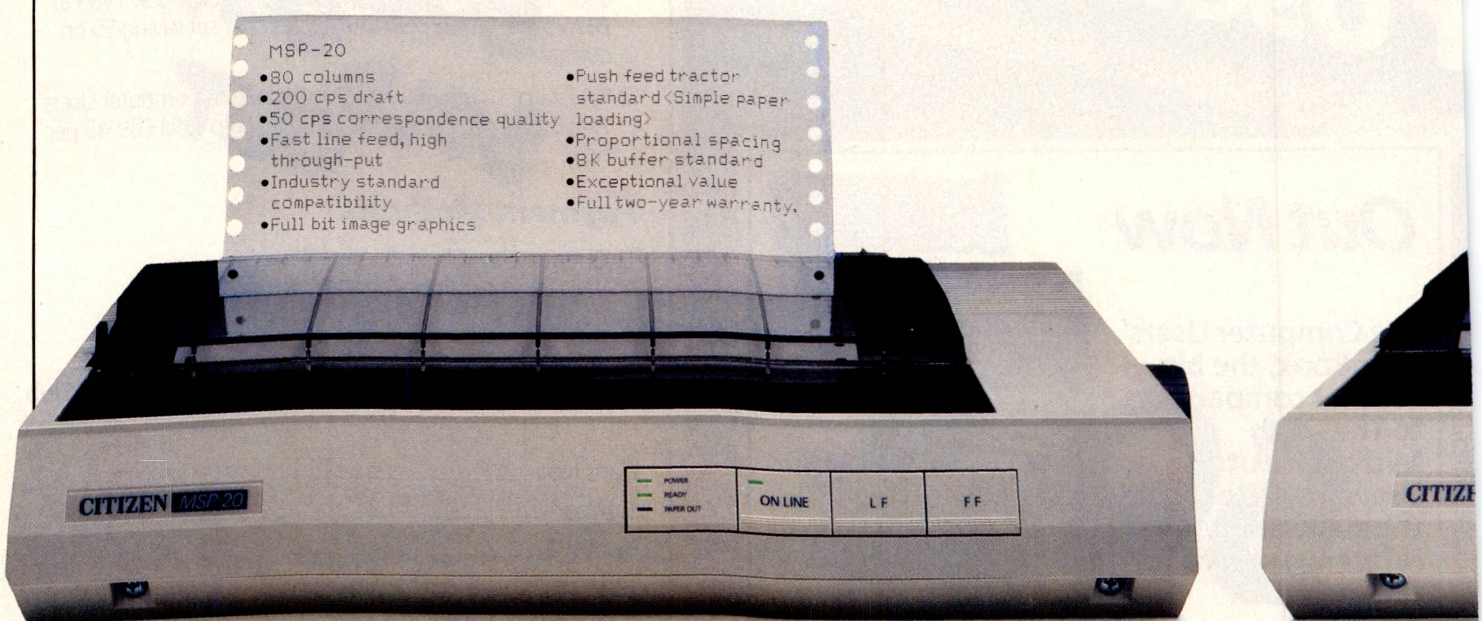




Four printers about two

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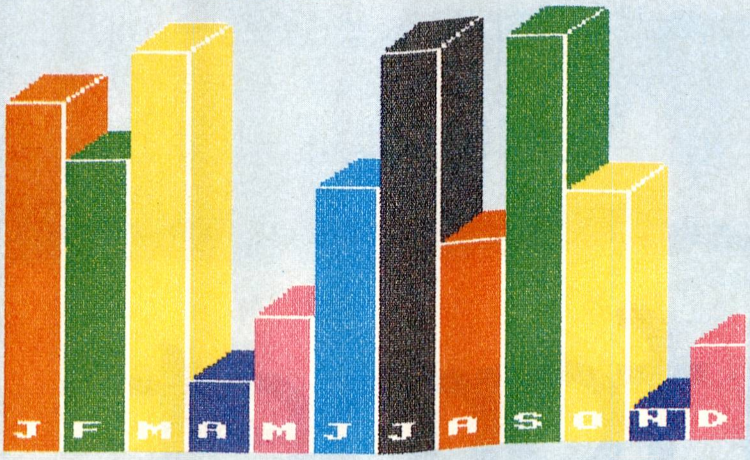

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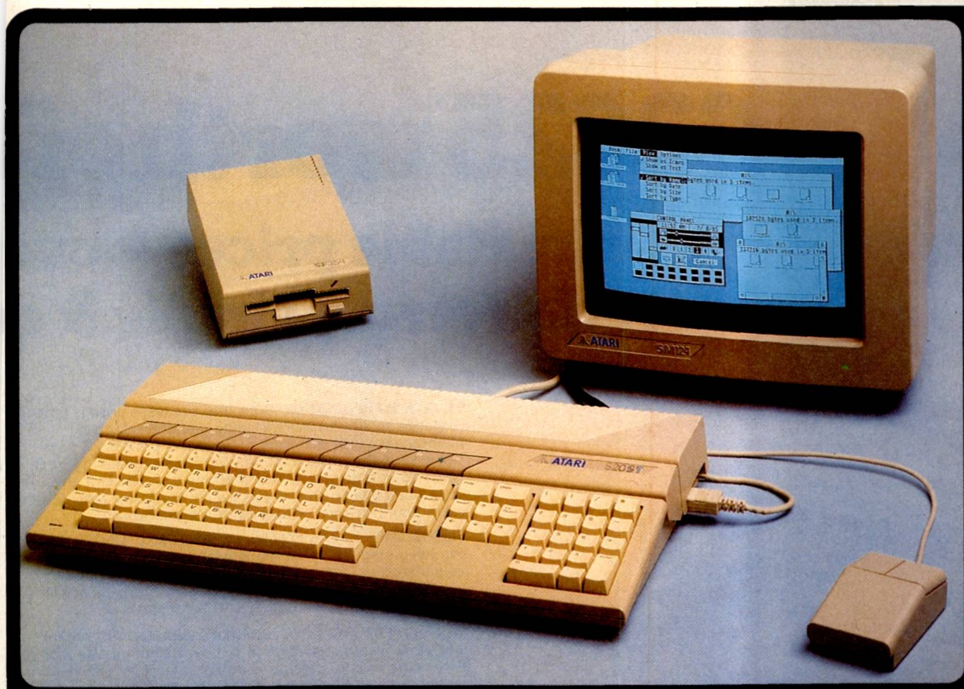

ATARI ST

520ST

POWER WITHOUT THE PRICE

THE NEW ATARI 520ST

Under the new leadership of Jack Tramiel (former boss and founder of Commodore Business Machines), Atari Corporation have marked their entry into the world of business/personal computers with a machine which leaves the competition standing. Tramiel's slogan 'Power Without the Price' has been implemented in the manufacture of the new 512K Atari 520ST colour computer which offers the user amazingly high performance at an incredibly low price. Launched as a work-station, this new system incorporates seven software packages as well as the 520ST computer with 512K RAM, mouse controller, high resolution monochrome monitor (640x400), 95 key keyboard (with 18 key numeric keypad), MIDI interface, GEM and a 500K 3½ inch disk drive, all for the package price of only £651.30 (+VAT = £749). Dubbed the 'Mac beater' and the 'Jackintosh' (after Atari's Chief, Jack Tramiel), Atari's new machine has been directly compared with the Apple Macintosh RRP £2595 (+VAT = £2985) which offers similar features and capabilities but at a much higher price. Favourably reviewed by the UK's highly critical specialist computer press, the 520ST is likely to make a great impact in this country as a sophisticated alternative to an IBM PC, APRICOT or APPLE MACINTOSH. Unlike its overpriced competitors, the Atari 520ST can be linked up to a colour monitor to unleash a choice of up to 512 colours. The addition of colour brings out the full potential of graphics packages such as GEM.

USER FRIENDLY GEM OPERATING SYSTEM

The power of the ST is harnessed and made user friendly by the new operating system 'GEM' from Digital Research. GEM stands for Graphics Environment Manager and allows a user friendly colour or B/W graphics interface which closely resembles that of the Macintosh. This similarity extends to the use of moveable resizeable windows, icons to represent objects such as disks and disk drives, and the use of pull down menus and a mouse. The advantage of all this is that the computer becomes extremely easy to use. GEM has now been implemented for the Acorn, ACT, Atari, IBM, ICL, and Olivetti. Software written for GEM on one computer should also run under GEM on another computer. This will enable the market to quickly produce a large library of standard interchangeable software.

FREE SOFTWARE AND FUTURE EXPANSION

The Atari 520ST comes supplied with seven free software packages as listed below: 1) TOS -Tramiel Operating System based on CPM 68K. 2) GEM Graphics Environment Manager by Digital Research (DR) giving a WIMP (Window, Icon, Mouse, Pull down menu) environment. 3) DR GEM Paint for creating graphics masterpieces. 4) DR GEM Write for word processing. 5) Logo learning language to enable you to write your own programs easily using turtle graphics. 6) DR Personal Basic a powerful user friendly version of the Basic programming language. 7) BOS operating system giving you access to dozens of business applications packages already available on the market. Designed with future expansion in mind, the ST also features a host of different interfaces to the outside world and an impressive list of accessories is planned. Atari will soon be releasing a 1000K (1MB) 3½ inch disk drive, and a 15MB hard disk storage system as well as a mass storage compact disk (CD) player capable of storing an entire 20 volume encyclopedia on one disk. A full range of inexpensive printers are planned including dot matrix, daisywheel and thermal colour printers. With its unbeatable graphics, speed and software at a price which is far below that of any comparable personal computer currently on the market, the ST is all set to do battle with the competition. To receive further details of the ST from Silica Shop, just fill in the coupon below with your name and address details and post it to us.

Silica Shop Price: £651.30 + £97.70 VAT = £749.00 This price includes:

- ★ **512K RAM**
- ★ **B/W MONITOR**
- ★ **MOUSE**
- ★ **500K 3.5" DISK DRIVE**
- ★ **GEM**
- ★ **KEYBOARD (95 KEYS)**

£749

ATARI 520ST SPECIFICATION

MEMORY
512K RAM (524,288 bytes)
16K ROM expandable to 320K
Port for addnl 128K plug-in ROM cartridges
200K TOS operating system

GRAPHICS
Individually addressable 32K bit-mapped screen with 3 screen graphics modes:
320x200 pixels in 16 colours (low resolution)
640x200 pixels in 4 colours (med resolution)
640x400 pixels in monochrome (high res)
16 shades of grey in low res mode
512 colours available in low/medium res
8 levels of each in red, green and blue

ARCHITECTURE
4 custom designed chips:
GLUE Chip - MMU Memory Mngmnt Unit
DMA Controller - Graphics Processing Unit
16/32 bit Motorola 68000 processor at 8MHz
eight 32 bit data registers
eight 32 bit address registers
16 bit data bus/24 bit address bus
7 levels of interrupts/56 instructions
14 addressing modes/5 data types

DATA STORAGE
High speed hard disk interface
Direct memory access 1.33 Mbytes per second
CD (Compact Disc) interface
Built in cartridge access
Dedicated floppy disk controller

DISK DRIVE
500K (unformatted) s/sided 3½" floppy d/drive
349K (formatted) storage capacity

SOUND AND MUSIC
Sound Generator
Frequency control from 30Hz to above audible
3 voices (channels) in wave shaping sound in addition to a noise generator
Separate frequency and volume controls
Dynamic envelope controls
ADSR (Attack, Decay, Sustain, Release)
Noise generator
MIDI interface for external music synthesizers

KEYBOARD
Separate keyboard microprocessor
Standard QWERTY typewriter styling
Ergonomic angle and height
95 keys including 10 function keys
Numeric keypad — 18 keys including ENTER
One touch cursor control keypad

MONITOR
12" screen - high res monochrome monitor
640x400 monochrome resolution

VIDEO PORTS
Display - Low Resolution - 40 columns
Med/High Res - 40/80 plus cols
Medium res RGB (Red/Green/Blue) output
High resolution monochrome (Black & White)

COMMUNICATIONS
Bidirectional centronics parallel interface for printers, or modems capable of input/output
RS232C serial modem/printer interface
VT52 Terminal Emulation Software
Maximum Baud Rate up to 19,200
High speed hard disk interface
Floppy disk controller (Western Digital)
2 joystick ports (one for 2 button mouse)
MIDI interface for external music synthesizers

GEM WIMP ENVIRONMENT
WIMP - Window Icon Mouse Pop-down menus
Two button mouse controller
Icons/Pull down menus/Windows
GEM VDI - Virtual Device Interface
GEM AES - Application Environment Services
GEM BBT - Bit Block Transfer
Real time clock & calendar

SOFTWARE
GEM environment
with user friendly Macintosh style operation
'TOS' - Tramiel Operating System
Atari's own system based on CP/M 68K with hierarchical directory & file structure plus a host of MS DOS & UNIX command structures
'BOS' - Business Operating System
to run any standard BOS business programs
GEM desktop
with GEM PAINT graphics mgmt system and GEM WRITE word processor
Personal BASIC and DR Logo
originally written by Digital Research (DR) Very much like those on other machines except for the extensive use of pull down menus, mouse control and windows

VARIOUS
Dimensions: 470mmx240mmx60mm
Replaceable external power supplies
Expansion: 3½" floppy disk drives 500K/1,000K (two drives can be connected)
3½" 15Mb hard disk
CD (compact laser disc)
Dot matrix & d/wheel prntrs (black)
Thermal dot matrix (colour)
RGB & monochrome monitors

LANGUAGES
BASIC & LOGO supplied
Many others will soon be available, including:
Assembler, BCPL, C, Cobol, Compiled Basic
Lisp, Modular-2 and Pascal

Note: Some of the above specifications are pre-release and may therefore be subject to change

MACINTOSH v F1e v 520ST

"Imagine a Fat Mac - the 512K Apple Macintosh - but with a bigger screen, a far bigger keyboard with numeric keypad, cursor and function keys, and colour. That gives you some idea of what the Atari 520ST is like, except for two important things. First the Atari seems faster. Second the Atari system is about one third of the price."
June 1985 - Jack Schofield - **PRACTICAL COMPUTING**

	APPLE	APRICOT	ATARI
FEATURES OF BASIC SYSTEM	MACINTOSH	F1e	520ST
Price Includes B/W Monitor	YES	NO - extra £200	YES
Keyboard size mm (LxDxH)	330x147x50	450x167x28	470x240x60
Keyboard size ins (LxDxH)	13x5¾x2	17½x6½x1	18½x9½x2½
3½" D/Drive (Unformatted)	500K	500K	500K
3½" D/Drive (Formatted)	399K	315K	349K
WIMP (Window, Icon, Mouse ...)	Apple	ACT - Activity	GEM
Real-time Clock	YES	YES	YES
Polyphonic Sound Generator	YES	NO	YES
RS232 Serial Port	YES	YES	YES
Centronics Parallel Printer Port	NO	YES	YES
Dedicated Floppy Disk Controller	NO	YES	YES
Hard Disk DMA Interface	NO	YES	YES
Full stroke keyboard	YES	YES	YES
Number of keys on keyboard	59	92	95
Numeric Keypad	NO	YES (16 Keys)	YES (18 keys)
Cursor Control Keypad	NO	YES	YES
Function keys	NO	10	10
16-bit processor	68000	Intel 8086	68000
Processor running speed	8MHz	4.77MHz	8MHz
RAM size	512K	256K	512K
Number of graphics modes	1	4	3
Number of colours	Monochrome	16	512
Max Screen Resolution (pixels)	512 x 342	640 x 256	640 x 400
Mouse included	Single Button	NO - extra £95	Two Button
Replaceable External Power Pack	NO	NO	YES
Cartridge Socket	NO	NO	YES
Joystick Ports	NO	NO	YES (two)
MIDI Synthesiser Interface	NO	NO	YES
Monitor Size	9"	9" - extra £200	12"
RGB Video Output	NO	YES	YES

System Cost with: Mouse - Monochrome Monitor - 512K RAM - 500K Disk Drive

Price of basic system (exc VAT)	£2595+VAT	£595+VAT	£652+VAT
+ Mouse	Included	£95+VAT	Included
+ Monochrome Monitor	Included	£200+VAT	Included
+ Expansion to 512K RAM	Included	£295+VAT	Included
Price of complete system (exc VAT)	£2595+VAT	£1185+VAT	£652+VAT
PRICE rounded down including VAT	£2,984	£1,362	£749

PRESS COMMENT

"Atari's new corporate image as an aggressive low cost computer maker is likely to mirror that of Commodore where Mr. Tramiel established the maxim that 'Business is war'."
August 21st 1984 **FINANCIAL TIMES**

"This is the only personal computer I know of that comes with a Midi interface as standard."
Peter Bright March 1985 **PERSONAL COMPUTER WORLD**

"The (GEM) version running on the Atari 68000 machines will have the additional advantage of leaving the PC version standing." April 6th 1985 **PERSONAL COMPUTER NEWS**

"It would seem that GEM offers the ideal operating system."
March 7th 1985 **POPULAR COMPUTING WEEKLY**

"I found it (GEM) extremely easy to use and was very impressed with the way in which it disguises the unfriendly hardware and operating systems lurking under the surface."
Peter Bright Feb 1985 **PERSONAL COMPUTER WORLD**

"The electronics in the machine are a work of art ... The heart of the 520ST is a Motorola 68000, one of the most powerful 16-bit processors around and in many respects it is close to being a 32-bit chip ... when the machine appears in the shops, I'll be at the front end of the queue to buy one."
Peter Bright June 1985 **PERSONAL COMPUTER WORLD**

"This machine is significantly more powerful than an IBM PC ... If it's possible to design a sure-fire winning machine, this is it." May 11th 1985 **PERSONAL COMPUTER NEWS**

"... the use of GEM makes the new range of Atari computers so similar to the Macintosh (with the added attraction of colour); that they are already being called 'Jackintoshes'."
May 2nd 1985 **COMPUTING**

"The new Atari ST computers truly represent to the consumer what Jack Tramiel is saying — easy-to-use computing power without the price." March 1985 **ANALOG COMPUTING**

"It (the ST) uses the most modern technology that is affordable, in a package that gives a professional impression."
May 23rd 1985 **POPULAR COMPUTING WEEKLY**

"The Atari ST is one of the most elegant designs I have seen ... Atari has used an original and elegant method of memory management which should make the ST faster than any other PC on the market - in any price bracket ... The 64K dollar question is would I go out and spend money for one? To which the only answer is 'Try and stop me!'"
John Lambert July 1985 **ELECTRONICS & COMPUTING**

"The 520ST is technically excellent ... The 520ST hardware is the new standard by which others will be judged."
July 1985 **YOUR COMPUTER**

ATARI

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ATARI

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To: Silica Shop Ltd, Dept PCW 11/85, 1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX

PLEASE SEND ME FREE LITERATURE
ON THE NEW ATARI 520ST COMPUTER

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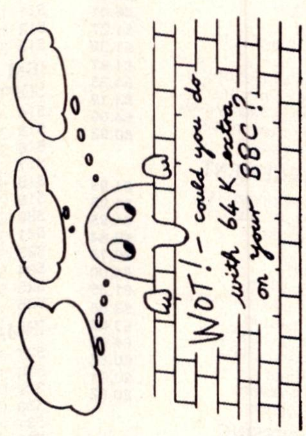

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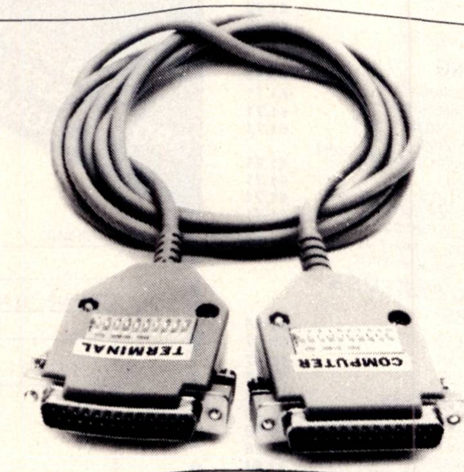

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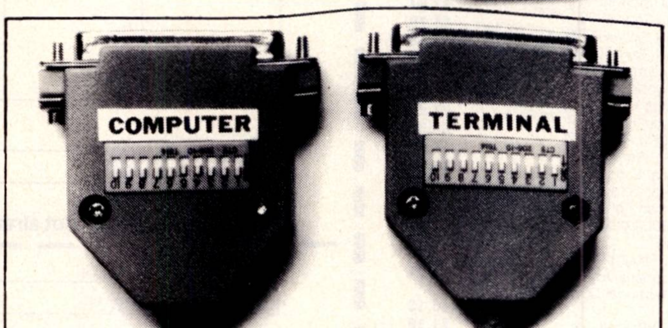

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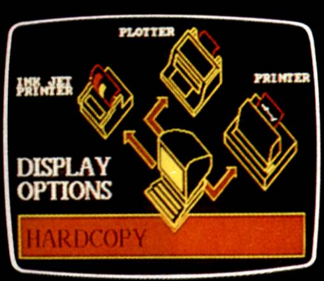

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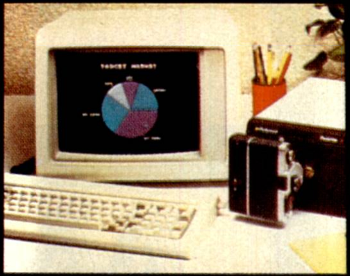

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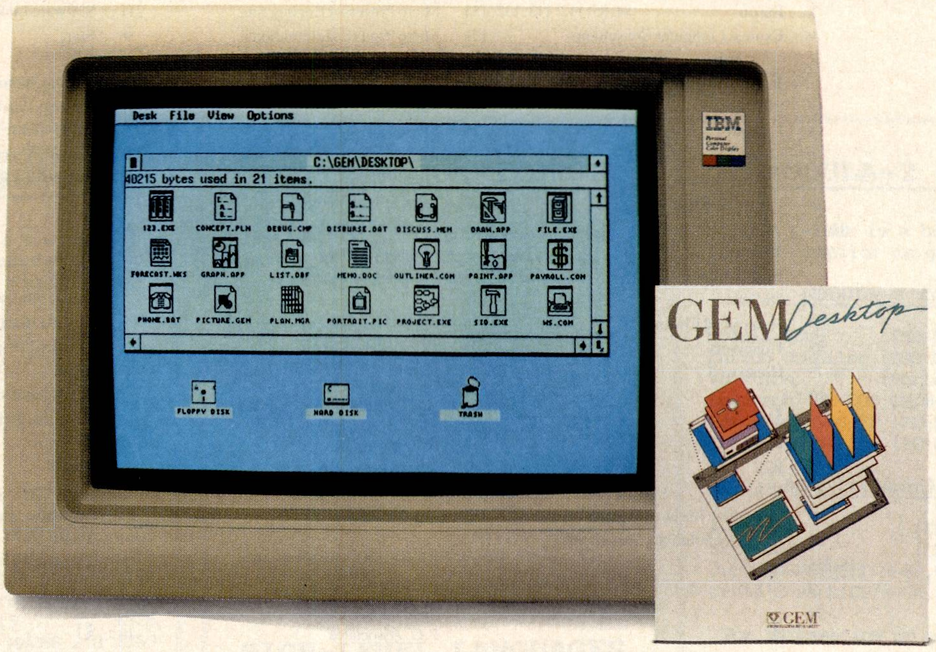

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ADVERTISERS INDEX

CHIP CHAT

These two wily gentleman have come up with chip-implanted chickens, a scheme to give you giant eggs at the press of a button. By taking advantage of the latest in surgical techniques, they've pioneered an operation to actually implant a printed circuit board into a chicken, enabling farmers to link the bird to a Commodore micro or IBM PC. One of the major benefits of this breakthrough is the production of eggs almost twice the size of those from chickens that have not received the upgrade.

Mirror magnate Robert Maxwell (the one in the photo wearing shoes) may have changed his mind about Sinclair — but he doesn't mind taking microcomputer money where he can find it. Maxwell is also chairman of Oxford United, which is being sponsored by Wang to the tune of £300,000. The club's record of rising from the Third to the First Division in three years speaks for itself. But judging by this photo the team may have profited from an element of surprise along the way — both in its choice of players and of tactics (put your left leg in, your left leg out, in out, in out, shake it all about — come on, Bob, you can do it if you try).

Beady Reds: two managers at one of the few Russian factories making micros are reported to have written in anger to a national paper. The cause of that anger? Only that their accountants are still doing their calculations on an abacus.

Chuff-not chuffed: Locomotive Systems, one of the unsung heroes behind the Amstrad success, is having problems licensing its own name. The bureaucrats are arguing that the chosen title should remain as a generic term for software to do with trains. Sounds loco to us.

The real thing: there's an old tale which claims that if you leave your false teeth in a glass of Coco-Cola overnight, they'll have been eaten away by the time morning comes. The same goes for Amstrad micros — as the company found out during the *PCW* Show when somebody spilled a can of the stuff over one of its machines.

Clouded Aspect: usually partings between advertising agencies and microcomputer companies are discreet events, with neither party wanting to spill the dirt on the other. But not in the case of Acorn and Aspect. The ad agency sent out a press release bluntly headed 'Aspect fires Acorn', saying that it had resigned the business because the new Acorn management was reconsidering all its options. In a tone of high dudgeon Aspect argues 'we feel extremely insulted that having stood by the company both financially and morally over the last seven, very traumatic months, they would like us to resubmit ourselves for consideration.'

No joy: a loud raspberry to the person who sheared off one of our joysticks during the *PCW* Show — thanks though for at least waiting until the last day before wielding the sharp instrument.

Breathing fire: the Dragon is still being advertised by California Digital in the American magazine *Byte*. Over there it costs $99 and (if you believe the advertisement) is 'a smash hit sell-out'. Casting a little doubt over the ad is its further claim that the machine is manufactured 'under licence of the British Broadcasting Company.'

Pressing matters: an ad in the *South Wales Echo* reckons that the Electron 'is the new personal computer from Acorn', while the *Salisbury Journal* refers to Parry Mitchell, the local Alliance parliamentary candidate, as being 'chairman of Britain's largest computer company'. Strange that, we didn't know United Leasing was bigger than IBM.

Walk on: the strangest sight at the *PCW* Show was the four women who turned up over-dressed in coats which soon came off to reveal little under-dressing coupled with an eagerness to introduce themselves to passing visitors. While the women were topless, whoever's products they were promoting may well have been brainless.

Hate mail: Amstrad's Alan Sugar appeared on television in August blithely pronouncing: 'We know how to look after our customers.' Perhaps he's not been reading the letters sent to his company by 644 purchasers angry at the cheaper price, higher spec and earlier than expected delivery of the 6128. Some of them don't feel so well looked after. For example, one of our readers finds 'it unbelievable that a company trying to enter the education market should have such a slapdash approach to sales and customers.' And that's just selecting one of the calmer comments . . .

Shock Horror: how many computer executives does it take to light a lightbulb? Perhaps just one, now that Computer Frontier's John Richards has had his personal magnetism measured at 9950v. The supercharged Mr Richards was put through the gold-leaf electroscope at the *PCW* Show, where Formica was launching its Static-Master range of computer de-zapping aids, and won himself a bottle of champagne. Careful though; if you rub Richards up the wrong way he'll stick to the curtains.

Burton on the button: criminals casing the International Business Show in October were shocked to find a stand taken by Burton International, 'arguably the largest detective agency in the United Kingdom'. Burton, apparently, runs a secret training school somewhere in the West Midlands where its undercover operatives — doubtless mingling with the IBS throngs — are intensively briefed. But the crooks could learn something from a video on the Burton stand demonstrating 'some of the methods of theft in yards and warehouses'. No tips on methods of theft from exhibitions, though. END

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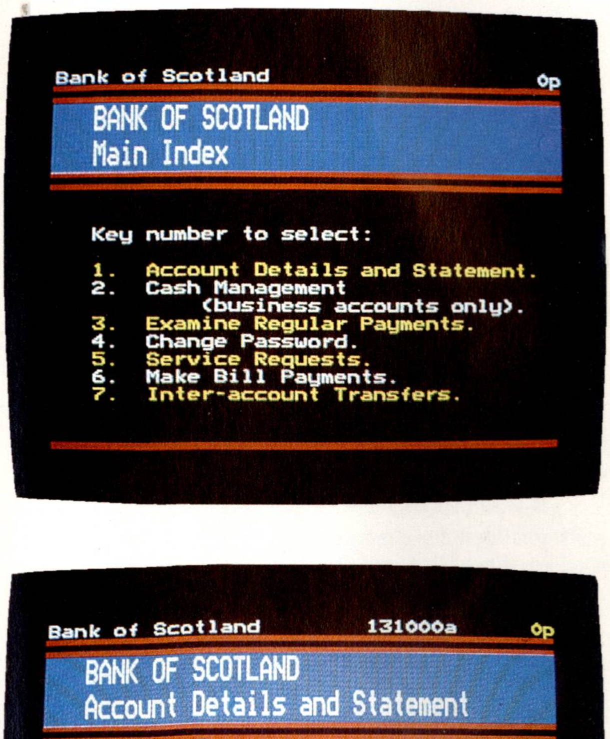


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